10. B.Tech. in Civil Engineering with Computer Applications

10. (a) Mission of the Department

Mission Stmt - 1	*To move up through international alliances and collaborative initiatives in civil engineering to achieve global excellence*
Mission Stmt - 2	*To accomplish a process to advance` knowledge in a rigorous research environment related to civil engineering and allied disciplines*
Mission Stmt - 3	*To attract and build people in a rewarding and inspiring environment by fostering freedom, empowerment, creativity and innovation.*

10. (b) Program Educational Objectives (PEO)

PEO - 1	*Graduates will pursue higher studies in civil engineering software applications, management and other related fields*
PEO - 2	*Graduates will perform as professional engineers in the fields of civil engineering*
PEO - 3	*Graduates will perform in diverse fields and gradually move into teamwork and leadership positions.*
PEO - 4	*Graduates will contribute to the development of the profession, nation and society*

10. (c) Mission of the Department to Program Educational Objectives (PEO) Mapping

	Mission Stmt. - 1	Mission Stmt. - 2	Mission Stmt. - 3
PEO - 1	*H*	*H*	*M*
PEO - 2	*H*	*M*	*H*
PEO - 3	*H*	*M*	*H*
PEO - 4	*H*	*M*	*H*

H – High Correlation, M – Medium Correlation, L – Low Correlation

10. (d) Mapping Program Educational Objectives (PEO) to Program Learning Outcomes (PLO)

	Program Learning Outcomes (PLO)														
	Graduate Attributes (GA)												Program Specific Outcomes (PSO)		
	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
PEO - 1	*H*	*H*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*H*	*H*
PEO - 2	*H*	*H*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*H*	*H*
PEO - 3	*L*	*L*	*L*	*L*	*M*	*M*	*L*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*M*
PEO - 4	*L*	*L*	*L*	*L*	*L*	*H*	*H*	*H*	*M*	*M*	*M*	*H*	*M*	*M*	*M*

H – High Correlation, M – Medium Correlation, L – Low Correlation

PSO – Program Specific Outcomes (PSO)

PSO - 1	*Graduates apply the knowledge of mathematical and physical sciences to solve problems in structural engineering, construction engineering management, geotechnical engineering, water resources engineering, environmental engineering and transportation engineering*
PSO - 2	*Graduates are capable of handling and applying modern engineering tools, software, Remote Sensing and GIS for solving civil engineering related problems*
PSO - 3	*Graduates are capable of working in teams in laboratory and industrial environment and carrying out major design projects*

10. (e) Program Structure: B.Tech. in Civil Engineering with Computer Applications

Humanities & Social Sciences including Management Courses (H)

Course Code	Course Title	Hours/ Week L	T	P	C
18LEH101J	English	2	0	2	3
18LEH102J	Chinese	2	0	2	3
18LEH103J	French				
18LEH104J	German				
18LEH105J	Japanese				
18LEH106J	Korean				
18PDH101T	General Aptitude	0	0	2	1
18PDH102T	Management Principles for Engineers	2	0	0	2
18PDH103T	Social Engineering	2	0	0	2
18PDH201T	Employability Skills & Practices	0	0	2	1
	Total Learning Credits				**12**

Engineering Science Courses (S)

Course Code	Course Title	Hours/ Week L	T	P	C
18MES101L	Engineering Graphics and Design	1	0	4	3
18MES102J	Basic Civil and Mechanical Engineering	3	1	2	5
18EES102L	Electrical and Electronics Eng. Workshop	1	0	4	3
18CSS101J	Programming for Problem Solving	3	0	4	5
	Total Learning Credits				**16**

Mandatory Courses (M)

Code	Course Title	L	T	P	C
18PDM101L	Professional Skills and Practices	0	0	2	0
18PDM201L	Competencies in Social Skills	0	0	2	0
18PDM203L	Entrepreneurial Skill Development				
18PDM202L	Critical and Creative Thinking Skills	0	0	2	0
18PDM204L	Business Basics for Entrepreneurs				
18PDM301L	Analytical and Logical Thinking Skills	0	0	2	0
18PDM302L	Entrepreneurship Management				
18LEM101T	Constitution of India	1	0	0	0
18LEM102J	Value Education	1	0	1	0
18GNM101L	Physical and Mental Health using Yoga	0	0	2	0
18GNM102L	NSS	0	0	2	0
18GNM103L	NCC				
18GNM104L	NSO				
18LEM109T	Indian Traditional Knowledge	1	0	0	0
18LEM110L	Indian Art Form	0	0	2	0
18CYM101T	Environmental Science	1	0	0	0
18CEM401J	Professional Enhancement Course 1	1	0	2	0
18CEM402T	Professional Enhancement Course 2	1	0	0	0

Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P)

Course Code	Course Title	Hours/ Week L	T	P	C
18CEP101L	Massive Open Online Course - I	0	0	2	1
18CEP102L	Industrial Training-I				
18CEP103L	Seminar - I				
18CEP104L	Massive Open Online Course - II	0	0	2	1
18CEP105L	Industrial Training-II				
18CEP106L	Seminar - II				
18CEP107L	Minor Project	0	0	6	3
18CEP108L	Internship (4-6 weeks)				
18CEP109L	Project	0	0	20	10
18CEP110L	Semester Internship				
	Total Learning Credits				**15**

Professional Elective Courses (E)
Any 6 Courses

Course Code	Course Title	Hours/ Week L	T	P	C
	Structural Engineering				
18CEE305J	Concrete Technology	2	0	2	3
18CEE306T	Prestressed Concrete Structures	3	0	0	3
18CEE307T	Design of Earthquake Resistant Structures	3	0	0	3
18CEE308T	Design of Steel-Concrete Composite Structures	3	0	0	3
18CEE309T	Geographic Information System	3	0	0	3

Basic Science Courses (B)

Course Code	Course Title	Hours/ Week L	T	P	C
18PYB102J	Physics: Mechanics and Mechanics of Solids	3	1	2	5
18CYB101J	Chemistry	3	1	2	5
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18MAB201T	Transforms and Boundary Value Problems	3	1	0	4
18MAB202T	Numerical Methods for Engineers	3	1	0	4
18MAB301T	Probability and Statistics	3	1	0	4
18BTB101T	Biology	2	0	0	2
	Total Learning Credits				**32**

Professional Core Courses (C)

Course Code	Course Title	Hours/ Week L	T	P	C
18CEC201T	Engineering Geology	3	1	0	4
18CEC202T	Fluid Mechanics	2	1	0	3
18CEC202L	Fluid Mechanics Laboratory	0	0	2	1
18CEC203T	Mechanics of Structures	2	1	0	3
18CEC203L	Strength of Materials Laboratory	0	0	2	1
18CEC204T	Engineering Surveying	2	1	0	3
18CEC204L	Engineering Surveying Laboratory	0	0	2	1
18CEC205T	Structural Analysis	2	1	0	3
18CEC205L	Computer Aided Structural Analysis Laboratory	0	0	2	1
18CEC206T	Hydraulic Engineering and Design	2	1	0	3
18CEC206L	Hydraulic Engineering Laboratory	0	0	2	1
18CEC207T	Design of RC and Steel Structures	4	0	0	4
18CEC208T	Environmental Engineering and Design	2	1	0	3
18CEC208L	Environmental Engineering Laboratory	0	0	2	1
18CEC301T	Hydrology and Water Resources Engineering	3	1	0	4
18CEC302T	Geotechnical Engineering	2	1	0	3
18CEC302L	Geotechnical Engineering Laboratory	0	0	2	1
18CEC303T	Highway Engineering and Design	2	1	0	3
18CEC303L	Highway Engineering Laboratory	0	0	2	1
18CEC304T	Construction Engineering and Management	2	1	0	3
18CEC304L	Construction Engineering and Management Laboratory	0	0	2	1
18CEC350T	Comprehension	0	1	0	1
	Total Learning Credits				**49**

Open Elective Courses (O)
Any 6 Courses

Course Code	Course Title	Hours/ Week L	T	P	C
18CEO305J	Computer Application in Structural Engineering	1	0	4	3
18CEO306J	Computer Application in Construction Engineering and Management	1	0	4	3
18CE0307J	RS and GIS Application in Civil Engineering	1	0	4	3
18CEO308J	Computer Application in Geotechnical and Transportation Eng.	1	0	4	3
18CEO403J	Computer Application in Water Resources and Environmental Engineering	1	0	4	3
18CEO404J	Fundamentals of Computing	2	0	2	3
	Total Learning Credits				**18**
	Courses offered to other Engineering branches				
18CEO305T	Environmental Impact Assessment	3	0	0	3
18CEO306T	Municipal Solid Waste Management	3	0	0	3
18CEO307T	Disaster Mitigation and Management	3	0	0	3
18CEO405T	Water Pollution and its Management	3	0	0	3
18CE0406T	Global Warming and Climate Change	3	0	0	3
18CE0407T	Applications of Remote Sensing and GIS	3	0	0	3
	Total Learning Credits				**18**

Professional Elective Courses (E)
Any 6 Courses

Course Code	Course Title	Hours/ Week L	T	P	C
	Geotechnical Engineering				
18CEE301T	Foundation Engineering and Design	3	0	0	3
18CEE302T	Geotechnical Design	3	0	0	3
18CEE303T	Ground Improvement Techniques	3	0	0	3
18CEE304T	Foundation on Expansive Soil	3	0	0	3
	Water Resources Engineering				
18CEE313T	Design of hydraulic structures and Irrigation Engineering	3	0	0	3
18CEE314T	Ground Water Engineering	3	0	0	3

	Environmental Engineering				
18CEE310T	*Solid and Hazardous Waste Management*	*3*	*0*	*0*	*3*
18CEE311T	*Air and Noise Pollution and Control*	*3*	*0*	*0*	*3*
18CEE312T	*Environmental Impact Assessment and Life Cycle Analysis*	*3*	*0*	*0*	*3*
18CEE315T	*Surface Hydrology*	*3*	*0*	*0*	*3*
	Transportation Engineering				
18CEE401T	*Pavement Analysis and Design*	*3*	*0*	*0*	*3*
18CEE402T	*Railways, Airport and Harbour Engineering*	*3*	*0*	*0*	*3*
18CEE403T	*Traffic Engineering and Management*	*3*	*0*	*0*	*3*
	Construction Engineering and Mgmt.				
18CEE404T	*Construction Equipment and Automation*	*3*	*0*	*0*	*3*
18CEE405T	*Contracts Management*	*3*	*0*	*0*	*3*
18CEE406T	*Repairs and Rehabilitation of Structures*	*3*	*0*	*0*	*3*
18CEE407T	*Sustainable Construction Methods*	*3*	*0*	*0*	*3*
	Total Learning Credits				**18**

10. (f) Program Articulation: B.Tech. in Civil Engineering with Computer Applications

Course Code	Course Name	Program Learning Outcomes (PLO)													
		Graduate Attributes											PSO		
		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
18CEC201T	*Engineering Geology*	*H*	*H*	*M*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*M*	*M*	*M*
18CEC202T	*Fluid Mechanics*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*M*	*M*	*M*
18CEC202L	*Fluid Mechanics Laboratory*	*H*	*H*	*M*	*M*	*M*	*L*	*M*	*M*	*L*	*M*	*L*	*H*	*M*	*M*	*L*
18CEC203T	*Mechanics of Structures*	*H*	*M*	*M*	*M*	*M*	*L*	*M*	*L*	*M*	*M*	*L*	*H*	*H*	*H*	*H*
18CEC203L	*Strength of Materials Laboratory*	*H*	*M*	*M*	*M*	*M*	*L*	*M*	*L*	*M*	*M*	*M*	*H*	*H*	*H*	*H*
18CEC204T	*Engineering Surveying*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*M*	*M*	*M*	*M*
18CEC204L	*Engineering Surveying Laboratory*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	*M*	*L*	*M*	*H*	*L*	*H*	*L*
18CEC205T	*Structural Analysis*	*H*	*H*	*M*	*H*	*M*	*L*	*M*	*M*	*L*	*L*	*M*	*H*	*M*	*L*	*M*
18CEC205L	*Computer Aided Structural Analysis Laboratory*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*M*	*L*	*L*	*L*
18CEC206T	*Hydraulic Engineering and Design*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	*H*	*L*	*M*	*H*	*H*	*H*	*L*
18CEC206L	*Hydraulic Engineering Laboratory*	*H*	*H*	*M*	*H*	*M*	*L*	*M*	*M*	*L*	*L*	*M*	*H*	*M*	*L*	*M*
18CEC207T	*Design of RC and Steel Structures*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*M*	*M*	*M*	*M*
18CEC208T	*Environmental Engineering and Design*	*H*	*H*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*L*	*L*	*L*
18CEC208L	*Environmental Engineering Laboratory*	*H*	*H*	*H*	*H*	*M*	*L*	*M*	*L*	*H*	*L*	*M*	*H*	*M*	*H*	*L*
18CEC301T	*Hydrology and Water Resources Engineering*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*L*
18CEC302T	*Geotechnical Engineering*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*M*	*L*	*L*	*H*	*H*	*M*	*M*
18CEC302L	*Geotechnical Engineering Laboratory*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*M*	*M*	*M*	*M*
18CEC303T	*Highway Engineering and Design*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*H*	*M*	*M*	*M*	*M*
18CEC303L	*Highway Engineering Laboratory*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*M*
18CEC304T	*Construction Engineering and Management*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*M*
18CEC304L	*Construction Engineering & Management Lab*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*M*
18CEC350T	*Comprehension*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*M*	*M*	*M*	*H*	*H*	*M*	*M*	*H*
18CEP101L	*Massive Open Online Course - I*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP102L	*Industrial Training-I*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP103L	*Seminar - I*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP104L	*Massive Open Online Course - II*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP105L	*Industrial Training-II*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP106L	*Seminar - II*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP107L	*Minor Project*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*M*
18CEP108L	*Internship (4-6 weeks)*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*M*
18CEP109L	*Project*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*M*
18CEP110L	*Semester Internship*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*M*
	Program Average	*H*	*H*	*M*	*H*	*M*	*L*	*M*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*M*

10. (g) Implementation Plan: B.Tech. in Civil Engineering with Computer Applications

Semester - I

Code	Course Title	Hours/ Week L	T	P	C
18LEH101J	English	2	0	2	3
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18PYB102J	Physics: Mechanics and Mechanics of Solids	3	1	2	5
18MES101L	Engineering Graphics and Design	1	0	4	3
18MES102J	Basic Civil and Mechanical Engineering	3	1	2	5
18PDM101L	Professional Skills and Practices	0	0	2	0
18LEM101T	Constitution of India	1	0	0	0
18GNM101L	Physical and Mental Health using Yoga	0	0	2	0
	Total Learning Credits				**20**

Semester - II

Code	Course Title	Hours/ Week L	T	P	C
18LEH10XJ	Chinese / French / German / Japanese/ Korean	2	0	2	3
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18CYB101J	Chemistry	3	1	2	5
18EES102L	Electrical and Electronics Eng. Workshop	1	0	4	3
18CSS101J	Programming for Problem Solving	3	0	4	5
18PDH101T	General Aptitude	0	0	2	1
18LEM102J	Value Education	1	0	1	0
18GNM102L	NSS	0	0	2	0
18GNM103L	NCC				
18GNM104L	NSO				
	Total Learning Credits				**21**

Semester - III

Code	Course Title	Hours/ Week L	T	P	C
18MAB201T	Transforms and Boundary Value Problems	3	1	0	4
18BTB101T	Biology	2	0	0	2
18CEC201T	Engineering Geology	3	1	0	4
18CEC202T	Fluid Mechanics	2	1	0	3
18CEC202L	Fluid Mechanics Laboratory	0	0	2	1
18CEC203T	Mechanics of Structures	2	1	0	3
18CEC203L	Strength of Materials Laboratory	0	0	2	1
18CEC204T	Engineering Surveying	2	1	0	3
18CEC204L	Engineering Surveying Laboratory	0	0	2	1
18PDH102T	Management Principles for Engineers	2	0	0	2
18PDM201L	Competencies in Social Skills	0	0	2	0
18PDM203L	Entrepreneurial Skill Development				
	Total Learning Credits				**24**

Semester - IV

Code	Course Title	Hours/ Week L	T	P	C
18MAB202T	Numerical Methods for Engineers	3	1	0	4
18CEC205T	Structural Analysis	2	1	0	3
18CEC205L	Computer Aided Structural Analysis Laboratory	0	0	2	1
18CEC206T	Hydraulic Engineering and Design	2	1	0	3
18CEC206L	Hydraulic Engineering Laboratory	0	0	2	1
18CEC207T	Design of RC and Steel Structures	4	0	0	4
18CEC208T	Environmental Engineering and Design	2	1	0	3
18CEC208L	Environmental Engineering Laboratory	0	0	2	1
18PDH103T	Social Engineering	2	0	0	2
18PDM202L	Critical and Creative Thinking Skills	0	0	2	0
18PDM204L	Business Basics for Entrepreneurs				
18CYM101T	Environmental Science	1	0	0	0
	Total Learning Credits				**22**

Semester - V

Code	Course Title	Hours/ Week L	T	P	C
18MAB301T	Probability and Statistics	3	1	0	4
18CEC301T	Hydrology and Water Resources Engineering	3	1	0	4
18CEC302T	Geotechnical Engineering	2	1	0	3
18CEC302L	Geotechnical Engineering Laboratory	0	0	2	1
	Professional Elective – 1	3	0	0	3
	Open Elective – 1	3	0	0	3
	Open Elective – 2	3	0	0	3
18CEP101L	Massive Open Online Course - I	0	0	2	1
18CEP102L	Industrial Training-I				
18CEP103L	Seminar - I				
18PDM301L	Analytical and Logical Thinking Skills	0	0	2	0
18PDM302L	Entrepreneurship Management				
18LEM109T	Indian Traditional Knowledge	1	0	0	0
	Total Learning Credits				**22**

Semester - VI

Code	Course Title	Hours/ Week L	T	P	C
18CEC303T	Highway Engineering and Design	2	1	0	3
18CEC303L	Highway Engineering Laboratory	0	0	2	1
18CEC304T	Construction Engineering and Management	2	1	0	3
18CEC304L	Construction Engineering and Management Laboratory	0	0	2	1
18CEC350T	Comprehension	0	1	0	1
	Professional Elective – 2	3	0	0	3
	Professional Elective – 3	3	0	0	3
	Open Elective – 3	3	0	0	3
	Open Elective – 4	3	0	0	3
18CEP104L	Massive Open Online Course - II	0	0	2	1
18CEP105L	Industrial Training-II				
18CEP106L	Seminar - II				
18PDH201T	Employability Skills and Practices	0	0	2	1
18LEM110L	Indian Art Form	0	0	2	0
	Total Learning Credits				**23**

Semester - VII

Code	Course Title	Hours/ Week L	T	P	C
	Professional Elective – 4	3	0	0	3
	Professional Elective – 5	3	0	0	3
	Professional Elective – 6	3	0	0	3
	Open Elective – 5	3	0	0	3
	Open Elective – 6	3	0	0	3
18CEP107L	Minor Project	0	0	6	3
18CEP108L	Internship (4-6 weeks)				
18CEM401J	Professional Enhancement Course 1	1	0	2	0
	Total Learning Credits				**18**

Semester - VIII

Code	Course Title	Hours/ Week L	T	P	C
18CEP109L	Project	0	0	20	10
18CEP110L	Semester Internship				
18CEM402T	Professional Enhancement Course 2	1	0	0	0
	Total Learning Credits				**10**

Course Code	18MAB101T	Course Name	CALCULUS AND LINEAR ALGEBRA	Course Category	B	*Basic Sciences*	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Mathematics*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Application of Matrices in problems of Science and Engineering*
CLR-2 :	*Utilize Taylor series, Maxima minima, composite function and Jacobian in solving rea- time application problems*
CLR-3 :	*Apply the concept of Differential Equations in problems of Science and Engineering*
CLR-4 :	*Utilize the concepts of radius of curvature, evolute, envelope in problems of Science and Engineering*
CLR-5 :	*Application of Sequences and Series in all problems involving Science and Engineering*
CLR-6 :	*Utilize appropriate mathematical techniques for the different solutions required in Science and Engineering applications*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning 1 Level of Thinking (Bloom)	Learning 2 Expected Proficiency (%)	Learning 3 Expected Attainment (%)	PLO 1 Engineering Knowledge	PLO 2 Problem Analysis	PLO 3 Design & Development	PLO 4 Analysis, Design, Research	PLO 5 Modern Tool Usage	PLO 6 Society & Culture	PLO 7 Environment & Sustainability	PLO 8 Ethics	PLO 9 Individual & Team Work	PLO 10 Communication	PLO 11 Project Mgt. & Finance	PLO 12 Life Long Learning	PLO 13 PSO - 1	PLO 14 PSO - 2	PLO 15 PSO – 3
CLO-1 :	*Apply Matrices, Eigenvalues and Eigen Vectors Reduce to Quadratics form in Science and Engineering problem solving*	*2*	*80*	*80*	*H*	-	*H*	-	-	-	-	-	*H*	-	-	*H*	-	-	-
CLO-2 :	*Apply Maxima and Minima, Jacobian, and Taylor series to solve problems in Science and Engineering*	*2*	*85*	*80*	*H*	-	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Solve the different types of Differential Equations in Science and Engineering applications*	*2*	*85*	*80*	-	*H*	-		-	-	-	-	*H*	-	-	*H*	-	-	-
CLO-4 :	*Identify Radius, Centre, envelope and Circle of of curvature and apply them in the problem solving*	*2*	*90*	*90*	*H*	*H*	-	*H*	-	-	-	-	*H*	-	-	*H*	-	-	-
CLO-5 :	*Apply convergence and divergence of series using different test and apply sequences and Series in the problem solving*	*2*	*90*	*80*	-	*H*	*H*	-	-	-	-	-	*H*	-	-	*H*	-	-	-
CLO-6 :	*Identify, Analyze and Apply mathematical techniques to arrive at solutions in Science and Engineering*	*2*	*90*	*90*	*H*		*H*	-	-	-	-	-	*H*	-	-	*H*	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*Characteristic equation*	*Functions of two variables – Partial derivatives*	*Linear equations of second order with constant coefficients when PI=0 or exp.*	*Radius of Curvature – Cartesian coordinates*	*Series of Positive terms – Test of Convergence-*
	SLO-2	*Eigen values of a real matrix*	*Total differential*	*Linear equations of second order with constant coefficients when PI=sinx or cosx*	*Radius of Curvature – Cartesian coordinates*	*Comparison test – Integral test-*
S-2	SLO-1	*Eigen vectors of a real matrix*	*Total differential*	*Linear equations of second order with constant coefficients when PI=polynomial*	*Radius of Curvature – Polar coordinates*	*Comparison test – Integral test-*
	SLO-2	*Eigen vectors of a real matrix*	*Taylor's expansion with two variables up to second order terms*	*Linear eqn. of second order with constant coefficients when PI=exp. with sinx / Cosx*	*Radius of Curvature – Polar coordinates*	*Comparison test – Integral test-.*
S-3	SLO-1	*Properties of Eigen values*	*Taylor's expansion with two variables up to third order terms*	*Linear eqn. of second order with constant coefficients when PI= exp.I with polynomial*	*Circle of curvature*	*D'Alemberts Ratio test,*
	SLO-2	*Cayley – Hamilton theorem*	*Maxima and Minima*	*Linear eqn. of 2nd order with const. coeff. when PI=polynomial with sinax or cosax*	*Circle of curvature*	*D'Alemberts Ratio test,*
S-4	SLO-1	*Problem solving using tutorial sheet 1*	*Problem solving using tutorial sheet 4*	*Problem solving using tutorial sheet 6*	*Problem solving using tutorial sheet 11*	*Problem solving using tutorial sheet 14*
	SLO-2	*Problem solving using tutorial sheet 1*	*Problem solving using tutorial sheet 4*	*Problem solving using tutorial sheet 6*	*Applications of Radius of curvature in engineering*	*Problem solving using tutorial sheet 14*
S-5	SLO-1	*Finding A inverse using Cayley – Hamilton theorem*	*Maxima and Minima*	*Linear equations of second order variable coefficients*	*Centre of curvature*	*Raabe's root test.*
	SLO-2	*Finging higher powers of A using Cayley – Hamilton theorem*	*Maxima and Minima*	*Linear equations of second order variable coefficients*	*Centre of curvature*	*Raabe's root test.*
S-6	SLO-1	*orthogonal reduction of a symmetric matrix to diagonal form*	*Maxima and Minima*	*Homogeneous equation of Euler type*	*Centre of curvature*	*Covergent of Exponential Series*
	SLO-2	*orthogonal reduction of a symmetric matrix*	*Constrained Maxima and Minima by*	*Homogeneous equation of Legendre's*	*Evolute of a parabola*	*Cauchy's Root test*

		to diagonal form	*Lagrangian Multiplier method*	*Type*		
S-7	SLO-1	*orthogonal reduction of a symmetric matrix to diagonal form*	*Constrained Maxima and Minima by Lagrangian Multiplier method*	*Homogeneous equation of Legendre's Type*	*Evolute of an ellipse*	*Log test*
	SLO-2	*orthogonal reduction of a symmetric matrix to diagonal form*	*Constrained Maxima and Minima by Lagrangian Multiplier method*	*Equations reducible to homogeneous form*	*Envelope of standard curves*	*Log test*
S-8	SLO-1	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 9*	*Problem solving using tutorial sheet 12*	*Problem solving using tutorial sheet 15*
	SLO-2	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 9*	*Applications of Curvature in engineering*	*Problem solving using tutorial sheet 15*
S-9	SLO-1	*Reduction of Quadratic form to canonical*	*Jacobians of two Variables*	*Equations reducible to homogeneous form*	*Beta Gamma Functions*	*Alternating Series: Leibnitz test*
	SLO-2	*Quadratic form to canonical form by orthogonal transformations*	*Jacobians of Three variables*	*Variation of parameters*	*Beta Gamma Functions and Their Properties*	*Alternating Series: Leibnitz test*
S-10	SLO-1	*Quadratic form to canonical form by orthogonal transformations*	*Jacobians problems*	*Variation of parameters*	*Sequences – Definition and Examples*	*Series of positive and Negative terms.*
	SLO-2	*Orthogonal matrices*	*Jacobians Problems*	*Simultaneous first order equations with constant co-efficient.*	*Series – Types of Convergence*	*Series of positive and Negative terms.*
S-11	SLO-1	*Reduction of quadratic form to canonical form*	*Properties of Jacobians and Problems*	*Simultaneous first order equations with constant co-efficient.*	*Series of Positive terms – Test of Convergence-*	*Absolute Convergence*
	SLO-2	*Reduction of quadratic form to canonical form*	*Properties of Jacobians and problems*	*Simultaneous first order equations with constant co-efficient.*	*Comparison test – Integral test-*	*Conditional Convergence*
S-12	SLO-1	*Problem solving using tutorial sheet 3*	*Application of Taylor's series Maxima Minima Jacobians in Engineering*	*Problem solving using tutorial sheet 10*	*Problem solving using tutorial sheet 13*	*Problem solving using tutorial sheet 13*
	SLO-2	*Applications of Matrices in Engineering*	*Application of Taylor's series Maxima Minima Jacobians in Engineering*	*Applications of Differential Equation in engineering*	*Problem solving using tutorial sheet 13*	*Applications Convergence of series in engineering*

Learning Resources	*1. B. H. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.* *2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.* *3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008*	*4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010* *5. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002* *6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. V. Maheshwaran, CTS, Chennai, maheshwaranv@yahoo.com	*1. Dr. K. C. Sivakumar, IIT, Madras, kcskumar@iitm.ac.in*	*1. Dr. A. Govindarajan, SRMIST*
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	*2. Dr. Nanjundan, Bangalore University, nanzundan@gmail.com*	*2. Dr. Srinivasan, SRMIST*

Course Code	18MAB102T	Course Name	ADVANCED CALCULUS AND COMPLEX ANALYSIS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*18MAB101T*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Mathematics*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Evaluate Double and triple Integral and apply them in problems in Engineering Industries*
CLR-2 :	*Evaluate Surface, Volume Integral are Application of Gauss theorem, Stokes and Green's theorem in Engineering fields*
CLR-3 :	*Transform engineering problems into ODE, PDE and Integrals and solve them using Laplace / complex analytic methods*
CLR-4 :	*To know the properties of Complex functions and apply them in the all Engineering fields*
CLR-5 :	*Evaluate improper integrals involving complex functions using Residue theorem and apply them in Engineering fields*
CLR-6 :	*Identify how Engineering problems can be transformed in to simple mathematical constructs and solve the same*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning 1: Level of Thinking (Bloom)	Learning 2: Expected Proficiency (%)	Learning 3: Expected Attainment (%)	PLO 1: Engineering Knowledge	PLO 2: Problem Analysis	PLO 3: Design & Development	PLO 4: Analysis, Design, Research	PLO 5: Modern Tool Usage	PLO 6: Society & Culture	PLO 7: Environment & Sustainability	PLO 8: Ethics	PLO 9: Individual & Team Work	PLO 10: Communication	PLO 11: Project Mgt. & Finance	PLO 12: Life Long Learning	PLO 13: PSO - 1	PLO 14: PSO - 2	PLO 15: PSO – 3
CLO-1 :	*Evaluate multiple integrals using change of variables*	*3*	*95*	*90*	*H*	-	*H*	-	-	-	-	-	*H*	-	-	*H*	-	-	-
CLO-2 :	*Apply techniques of vector calculus in problems involving Science and Engineering. Solving Ordinary Differential Equations*	*3*	*90*	*85*	*H*	-	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Apply techniques of Laplace Transforms and inverse transform for problems in Science and Engineering*	*2*	*85*	*80*	-	*H*	-		-	-	-	-	*H*	-	-	*H*	-	-	-
CLO-4 :	*Apply complex analytic functions and its properties in solving problems*	*3*	*80*	*80*	*H*	*H*	-	*H*	-	-	-	-	*H*	-	-	*H*	-	-	-
CLO-5 :	*Evaluate improper integrals using Residue theorem involving problems in Science and Engineering*	*2*	*80*	*90*	-	*H*	*H*	-	-	-	-	-	*H*	-	-	*H*	-	-	-
CLO-6 :	*Create mathematical constructs for engineering problems and identify solutions to solve them*	*3*	*90*	*80*	*H*		*H*	-	-	-	-	-	*H*	-	-	*H*	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*Evaluation of double integration Cartesian and polar coordinates*	*Review of vectors in 2,3 dimensions*	*Laplace Transforms of standard functions*	*Definition of Analytic Function – Cauchy Riemann equations*	*Cauchy's integral formulae - Problems*
	SLO-2	*Evaluation of double integration of polar coordinates*	*Gradient, divergence*	*Transforms properties*	*Cauchy Riemann equations*	*Cauchy's integral formulae- Problems*
S-2	SLO-1	*Evaluation of double integration of polar coordinates*	*curl – Solenoidal*	*Transforms of Derivatives and Integrals*	*Properties of analytic function functions*	*Cauchy's integral formulae- Problems*
	SLO-2	*Evaluation of double integration of polar coordinates*	*Irrotational fields*	*Transform of derivatives and integrals*	*Determination of analytic function using – Milne-Thomson's method*	*Taylor's expansions with simple problems*
S-3	SLO-1	*Evaluation of double integral by changing the order of integration*	*Vector identities (without proof) – Directional derivatives*	*Initial value theorems (without proof) and verification for some problems*	*Determination of analytic function using – Milne-Thomson's method*	*Taylor's expansions with simple problems*
	SLO-2	*Evaluation of double integral by changing the order of integration*	*Line integrals*	*Final value theorems (without proof) and verification for some problems*	*Determination of analytic function using – Milne-Thomson's method*	*Laurent's expansions with simple problems*
S-4	SLO-1	*Problem solving using tutorial sheet 1*	*Problem solving using tutorial sheet 4*	*Problem solving using tutorial sheet 7*	*Problem solving using tutorial sheet 10*	*Problem solving using tutorial sheet 13*
	SLO-2	*Problem solving using tutorial sheet 1*	*Problem solving using tutorial sheet 4*	*Problem solving using tutorial sheet 7*	*Problem solving using tutorial sheet 10*	*Problem solving using tutorial sheet 13*
S-5	SLO-1	*Evaluation of double integral by changing the order of integration*	*Line integrals*	*Inverse Laplace transforms using partial fractions*	*Conformal mappings: magnification*	*Laurent's expansions with simple problems*
	SLO-2	*Area as a double integral (Cartesian)*	*Surface integrals*	*Inverse Laplace transforms using Partial fractions*	*Conformal mappings: rotation*	*Singularities*
S-6	SLO-1	*Area as a double integral (Cartesian)*	*Surface integrals*	*Inverse Laplace transforms using second shifting theorem*	*Conformal mappings: inversion*	*Types of Poles and Residues*
	SLO-2	*Area as a double integral (polar)*	*Volume Integrals*	*LT using Convolution theorem -problems*	*Conformal mappings: inversion*	*Types of Poles and Residues*

				only		
S-7	SLO-1	*Area as a double integral (polar)*	*Green's theorem (without proof),*	*LT using Convolution theorem -problems only*	*Conformal mappings: reflection*	*Cauchy's residue theorem (without proof)-*
	SLO-2	*Triple integration in Cartesian coordinates*	*Green's theorem (without proof),*	*ILT using Convolution theorem -problems only*	*Conformal mappings: reflection*	*Contour integration: Unit circle.*
S-8	SLO-1	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 8*	*Problem solving using tutorial sheet 11*	*Problem solving using tutorial sheet 14*
	SLO-2	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 8*	*Problem solving using tutorial sheet 11*	*Problem solving using tutorial sheet 14*
S-9	SLO-1	*Conversion from Cartesian to polar in double integrals*	*Gauss divergence theorem (without proof), verification*	*LT of periodic functions -problems only*	*bilinear transformation*	*Contour integration: Unit circle.*
	SLO-2	*Conversion from Cartesian to polar in double integrals*	*Gauss divergence theorem (without proof) applications to cubes.*	*LT of periodic functions -problems only*	*bilinear transformation*	*Contour integration: Unit circle*
S-10	SLO-1	*Triple integration in Cartesian coordinates*	*Gauss divergence theorem (without proof applications to parallelepiped.*	*Solve linear second order ordinary diff. equations with constant coefficient only*	*bilinear transformation*	*Contour integration: semicircular contour.*
	SLO-2	*Triple integration in Cartesian coordinates*	*Stoke's theorems (without proof) – Verification*	*Solve linear second order ordinary diff. equations with constant coefficient only*	*bilinear transformation*	*Contour integration: semicircular contour.*
S-11	SLO-1	*Triple integration in Cartesian coordinates*	*Stoke's theorems (without proof) – Applications to cubes*	*Solution of Integral equation and integral equation involving convolution type*	*Cauchy's integral theorem (without proof)*	*Contour integration: semicircular contour.*
	SLO-2	*Volume as a triple Integral*	*Stoke's theorems (without proof) – Applications to parallelepiped only.*	*Solution of Integral equation and integral equation involving convolution type*	*Cauchy's integral theorem applications*	*Contour integration: semicircular contour.*
S-12	SLO-1	*Problem solving using tutorial sheet 3*	*Problem solving using tutorial sheet 6*	*Problem solving using tutorial sheet 9*	*Problem solving using tutorial sheet 12*	*Problem solving using tutorial sheet 15*
	SLO-2	*Application of Multiple integral in engineering*	*Application of Line and Volume Integrals in engineering*	*Application of Laplace Transform in engineering*	*Application of Bilinear Transformation and Cauchy Integral in engineering*	*Application Contour integration in engineering*

Learning Resources	*1. B. H. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.* *2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.* *3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008*	*4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010* *5. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002* *6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. V. Maheshwaran, CTS, Chennai, maheshwaranv@yahoo.com	*1. Dr. K. C. Sivakumar, IIT, Madras, kcskumar@iitm.ac.in*	*1. Dr. A. Govindarajan, SRMIST*
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	*2. Dr. Nanjundan, Bangalore University, nanzundan@gmail.com*	*2. Dr. Srinivasan, SRMIST*

Course Code	18BTB101T	Course Name	BIOLOGY	Course Category	B	Basic Sciences	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Recall the cell structure and function from its organization			
CLR-2 :	Discuss molecular and biochemical basis of an organism			
CLR-3 :	Compare enzyme reaction and photosynthesis			
CLR-4 :	Explain different types of biosensors			
CLR-5 :	Analyze the different types of bioremediation			
CLR-6 :	Relate the concept of nervous and immune system pertaining to diseases			
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Describe the cell growth, metabolism and reproduction.	1	80	80
CLO-2 :	Explain the concepts and experiments in biochemistry	2	85	75
CLO-3 :	Recognize the significance of photosynthesis	2	75	80
CLO-4 :	Discuss the different methods in enzyme catalytic functions	2	85	80
CLO-5 :	Analyze the role of biosensors and its applications	3	85	75
CLO-6 :	Explain the concepts of nervous system disorder and the diseases associated with it	2	80	80

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
L	H	H	H	-	M	L	H	H	H	-	H	L	H	H
M	H	H	M	-	-	M	H	L	H	-	H	L	H	H
M	H	M	H	M	M	-	M	H	H	-	H	L	H	H
L	H	H	H	-	-	H	L	L	H	-	H	M	H	H
L	H	H	M	-	M	H	H	H	L	-	H	H	H	H
M	H	H	H	L	H	M	M	H	H	-	H	H	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Basics of cell biology: Relevance to Engineers	Biochemistry: Macromolecules, Biodiversity and its importance	Bioenergetics and metabolism	Molecular machines and motors	Nervous system:History of neuroscience
	SLO-2	Cell basic unit of life, Evidence for cell theory	Chemistry of life	Enzymes as biological catalysts, Significance of enzymes	Properties of ATP based protein molecular machines	Glial cells, Neurons
S-2	SLO-1	Cell structure and function	Biochemistry and human biology, DNA replication	Thermodynamics of enzymes	F0F1 ATP synthase motors, Coupling and coordination of motors	Action potential, Organization of nervous system
	SLO-2	Genetic Information, Protein structure	Transcription, Protein synthesis	Factors affecting enzyme activity, Effect of inhibitors on enzyme activity	Bacterial flagellar motor, Cytoskeleton	Central Nervous system, Peripheral nervous system
S-3	SLO-1	Cell metabolism	Eukaryotic and prokaryotic protein synthesis difference	Mechanism of enzyme action	Microtubules	Diseases of nervous system
	SLO-2	Carbohydrate metabolism, Fatty acid metabolism	Concept of genetic code, Stem cells	Enzyme strategies, Restriction enzymes	Microfilaments, Intermediate filaments	Computer- based neural networks
S-4	SLO-1	Homeostasis	Source of stem cells, Classification of stem cells	NMP kinases, Photosynthesis	Kinesin linear motor, Dynein motor	Immune system
	SLO-2	Pathways that alter homeostasis, Cell growth	Human embryonic stem cell, Importance and applications of stem cells	Light reactions, Photosystems	Biosensor	Fluid systems of the body, Innate immune system
S-5	SLO-1	Reproduction	Therapeutic cloning	ATP synthesis in chloroplasts	Resonant biosensors, Glucose biosensors	Cells of innate immune system, Adaptive immunity

	SLO-2	*Eukaryotic cell division, Mitosis*	*Regenerative medicine*	*Calvin cycle*	*Bio detectors, Biosensor detection in pollutants*	*Diseases of immune system, Immune engineering*
S-6	SLO-1	*Meiosis, Cell differentiation*	*Bone tissue engineering*	*Significance of photosynthesis*	*Bioremediation*	*Cell signaling*
	SLO-2	*Neural crest*	*Gene therapy*	*Metabolism, Glycolysis*	*Bioventing and bio augmentation*	*Cell- surface receptors*

Learning Resources	**1.** *S. Thyagarajan, N.Selvamurugan, R.A.Nazeer et.al., Biology for engineers McGraw Hill Education. 2012*	2. *Norman Lewis, Gabi Nindl Waite, Lee R. Waite et.al., Applied Cell and Molecular Biology for Engineers. McGraw-Hill Education. 2007*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	18MAB201T	Course Name	TRANSFORMS AND BOUNDARY VALUE PROBLEMS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Describe types of Partial differential equations interpret solutions relate PDE to the respective branches of engineering			
CLR-2 :	Relate Fourier series expansion in solving problems under RMS value and Harmonic Analysis.			
CLR-3 :	Infer the most general form to the PDE and relate to half range sine and cosine series, as the case may be			
CLR-4 :	Evaluate the various types of integral transforms			
CLR-5 :	Conclude that the purpose of studying z transform is to solve linear difference equations having constant coefficients			
CLR-6 :	Predicting the importance of PDE, Fourier series, Boundary value problems and Fourier ,Z – transform applications			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Determine Partial differential equation	2	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-2 :	Explain the expansion of a discontinuous function as an infinite form of trigonometric sine and cosine series.	2	85	80	M	H	-	M	M	-	-	-	M	L	-	H	-	-	-
CLO-3 :	Decide a proper form of solution for the differential equations which are of hyperbolic and parabolic type	2	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	justify the relationship between aperiodic signals and linear combination of exponentials.	2	85	80	M	H	-	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Relate signal analysis with that of z transform	2	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Relate PDE, Fourier series, Boundary value problems, Fourier and Z transforms	2	85	80	L	L	L	H	H	H	L	H	H	H	-	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Formation of partial differential equation by eliminating arbitrary constants	Introduction of Fourier series - Dirichlet's conditions for existence of Fourier Series	Classification of second order partial differential equations	Introduction of Fourier Transforms	Introduction of Z-transform
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary constants	Fourier series –related problems in $(0,2\pi)$	Method of separation of variables	Fourier Transforms- problems	Z-transform-elementary properties
S-2	SLO-1	Formation of partial differential equation by eliminating arbitrary functions	Fourier series –related problems in $(-\pi,\pi)$	One dimensional Wave Equation and its possible solutions	Properties of Fourier transforms	Z-transform- change of scale property, shifting property
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary functions	Change of interval Fourier series –related problems in $(0,2l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 1 Algebraic function	Standard results of Fourier transform	Z-transform of $a^n, \frac{1}{n}, \frac{1}{n+1}$
S-3	SLO-1	Formation of partial differential equation by eliminating arbitrary functions of the form $\phi(u,v)=0$	Fourier series –related problems in $(-l,l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 2 Trigonometric function	Fourier Sine Transforms - problems	Z-transform of $\frac{1}{n^2}, \frac{1}{(n+1)^2}$
	SLO-2	Solution of first order non-linear partial differential equations-standard type I F(p,q)=0	Fourier series –half range cosine series related problems$(0,\pi)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 3 – Midpoint of the string is displaced	Fourier Cosine Transforms - problems	Z-transform of $r^n \cos n\theta$
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
	SLO-2					

S-5	SLO-1	*Solution of first order nonlinear partial differential equations-standard type –II Clairaut's form*	*Fourier series –half range cosine series related problems* $(0, l)$	*One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 1 Algebraic function*	*Properties of Fourier sine Transforms*	*Z-transform of* $r^n \sin n\theta$
	SLO-2	*Solution of first order non-linear partial differential equations-standard type III F(z, p, q)=0*	*Fourier series –half range sine series related problems* $(0, \pi)$	*One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 2 Trigonometric function*	*Fourier sine Transforms applications*	*Initial value theorem*
S-6	SLO-1	*Solution of first order non-linear partial differential equations-standard type-IV separation of variable f(x, p) = g(y, q)*	*Fourier series –half range sine series related problems* $(0, l)$	*Wave Equation-initial displacement with non-zero initial velocity Type 3 split function*	*Properties of Fourier cosine Transforms*	*Finial value theorem*
	SLO-2	*Lagrange's linear equation: Method of grouping*	*Parseval's Theorem (without proof)-related problems in Fourier series*	*One dimensional heat equation and its possible solutions*	*Fourier cosine Transforms applications*	*Inverse Z-transform- long division method*
S-7	SLO-1	*Lagrange's linear equation: Method of multipliers*	*Parseval's Theorem (without proof)-related problems in cosine series*	*One dimensional heat equation related problems*	*Convolution of two function*	*Inverse Z-transform, related problems, long division method*
	SLO-2	*More problems in Lagrange's linear equation: Method of multipliers*	*Parseval's Theorem (without proof)-related problems in sine series*	*One dimensional heat equation -Steady state conditions*	*Convolution Theorem*	*Inverse Z-transform, Partial fraction method*
S-8	SLO-1 SLO-2	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 8*	*Problem solving using tutorial sheet 11*	*Problem solving using tutorial sheet 14*
S-9	SLO-1	*Linear Homogeneous partial differential equations of second and higher order with constant coefficients-CF and PI Type 1:* e^{ax+by}	*Introduction to Harmonic Analysis*	*One dimensional heat equation -Steady state conditions more problems*	*Parseval's Identity for Fourier transform*	*Inverse Z-transform, Partial fraction method related problems*
	SLO-2	*PI Type2.: sin(ax+by) or cos(ax+by)*	*Harmonic Analysis for finding harmonic in* $(0,2\pi)$	*One dimensional heat equation -Steady state conditions with zero velocity*	*Parseval's Identity for Fourier sine & cosine transforms*	*Inverse Z-transform - residue theorem method*
S-10	SLO-1	*Type 3: PI of polynomial*	*Harmonic Analysis for finding harmonic in* $(0,2l)$	*One dimensional heat equation -Steady state conditions with zero velocity more problems*	*Parseval's Identity for Fourier sine & cosine transforms applications*	*Inverse Z-transform - residue theorem method-problems*
	SLO-2	*Type 4 Exponential shifting* $e^{ax+by}f(x,y)$	*Harmonic Analysis for finding harmonic in periodic interval* $(0,T)$	*One dimensional heat equation -Steady state conditions with zero velocity more related problems*	*Fourier Transforms Using Differentiation property*	*Convolution theorem (without proof)*
S-11	SLO-1	*Linear Homogeneous partial differential equations of second and higher order with constant coefficients type 5 General rule*	*Harmonic Analysis for finding cosine series*	*Steady state conditions and Non-zero boundary conditions- related problems*	*Solving integral equation*	*Convolution theorem applications*
	SLO-2	*Applications of Partial differential equations in Engineering*	*Harmonic Analysis for finding sine series*	*Steady state conditions and Non-zero boundary conditions- more problems*	*Self-reciprocal using Fourier Transform, sine and cosine transform*	*Solution of linear difference equations with constant coefficients using Z-transform*
S-12	SLO-1	*Problem solving using tutorial sheet 3*	*Problem solving using tutorial sheet 6*	*Problem solving using tutorial sheet 9*	*Problem solving using tutorial sheet 12*	*Problem solving using tutorial sheet 15*
	SLO-2	*Problem solving using tutorial sheet 3*	*Problem solving using tutorial sheet 6*	*Problem solving using tutorial sheet 9*	*Problem solving using tutorial sheet 12*	*Problem solving using tutorial sheet 15*

Learning Resources	1. *B. H. Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons,2006* 2. *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015* 3. *Veerarajan T., Transforms and Partial Differential Equations, Tata McGraw-Hill, New Delhi,2012*	4. *Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 3rd Edition, 2010* 5. *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, for third semester, Laxmi Publications, 3rd Edition, 2014*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. V. Maheshwaran, CTS, Chennai, maheshwaranv@yahoo.com	*1. Dr. K. C. Sivakumar, IIT, Madras, kcskumar@iitm.ac.in*	*1. Dr. A. Govindarajan, SRMIST*
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	*2. Dr. Nanjundan, Bangalore University, nanzundan@gmail.com*	*2. Prof. Ganapathy Subramanian K S, SRMIST*

Course Code	18MAB202T	Course Name	NUMERICAL METHODS FOR ENGINEERS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Acquire ability in solving mathematical problems numerically as applied to the respective branches of Engineering			
CLR-2 :	Apply the concept of interpolation for finding intermediate values of a well-known data			
CLR-3 :	Study the concept of numerical differentiation and integration			
CLR-4 :	Apply the numerical techniques for solutions of ordinary differential equations			
CLR-5 :	Apply the numerical techniques for solutions of partial differential equations			
CLR-6 :	Acquire analytical ability in solving mathematical problems numerically applied to the respective branches of Engineering			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Solve the algebraic, transcendental and simultaneous equations.	2	85	80	L	-	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-2 :	Find the finite differences and interpolation.	2	85	80	L	-	-	M	M	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Solve numerical Differentiation and integration.	2	85	80	-	M	-	-	-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Solve the numerical solutions of ordinary differential equations.	2	85	80	L	M	-	M	-	-	-	-	M	-	-	H	-	-	-
CLO-5 :	Solve the numerical solutions of partial differential equations	2	85	80	-	M	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Solve the problems numerically in science and engineering	2	85	80	H	-	H	-	-	-	-	-	H	-	-	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Method of Least Squares – Curve fitting.	First and Higher order differences.	Numerical Differentiation.	Numerical solutions for ordinary differential equations.	Numerical solutions for partial differential equations.
	SLO-2	Fitting a straight line.	Forward differences and backward differences.	Newton's forward difference formulae to compute first and higher order derivatives.	Solution by Taylor's series method.	Classification of partial differential equations.
S-2	SLO-1	Fitting a parabola.	Central Differences.	Newton's backward differences formulae to compute first and higher order derivatives.	Solutions of First order simultaneous differential equations by Taylor's series method.	Solution of Elliptic Equations.
	SLO-2	Calculation of the sum of the squares of the residuals of straight line and parabola.	Operators– Relations between the operators.	Problems by Newton's forward and backward differences formulae.	Euler's method.	Solution of Laplace Equations by Leibmann's Iterative process.
S-3	SLO-1	Solution of Algebraic and Transcendental equations.	Interpolation – Newton-Gregory Forward Interpolation formulae.	Applications of Newton's forward difference formulae to compute first and higher order derivatives.	Applications of Euler's method.	Solution of Laplace Equations by Leibmann's Iterative process.
	SLO-2	Newton-Raphson method.	Interpolation – Newton-Gregory Backward Interpolation formulae.	Applications of Newton's backward difference formulae to compute first and higher order derivatives.	Improved Euler's method.	Solution of Poisson Equations.
S-4	SLO-1	Problem solving using tutorial sheet 1.	Problem solving using tutorial sheet 4.	Problem solving using tutorial sheet 7.	Problem solving using tutorial sheet 10. Modified Euler's method	Problem solving using tutorial sheet 13.
	SLO-2					

S-5	SLO-1	*Bisection method and its applications.*	*Additional problems using Newton-Gregory Forward Interpolation formulae.*	*Additional problems for Newton's forward formulae to compute the application problems.*	*Applications of Improved and Modified Euler's method.*	*Problems for Poisson Equations.*
	SLO-2	*Problems using bisection method.*	*Additional problems using Newton-Gregory Backward Interpolation formulae.*	*Additional problems for Newton's backward formulae to compute the application problems.*	*Runge-Kutta method of fourth order.*	*Additional problems for Poisson Equations.*
S-6	SLO-1	*Regula-Falsi method.*	*Divided differences.*	*Numerical Integration.*	*Solution by Runge-Kutta method of fourth order.*	*Solution of Parabolic equations.*
	SLO-2	*Problems using false position method.*	*Formation of divided difference table.*	*Trapezoidal rule.*	*Additional problems using Runge-Kutta method of fourth order.*	*Bender-Schmidt formula*
S-7	SLO-1	*Solution of system of equations Direct Method - Gauss Elimination method.*	*Properties of Divided differences.*	*Simpson's one third rule.*	*Predictor-Corrector Methods.*	*Bender-Schmidt formula*
	SLO-2	*Solution of system of equations Direct Method – Gauss-Jordan method.*	*Properties of Divided differences.*	*Simpson's three eighth rule.*	*Milne-Thomson Method.*	*Bender-Schmidt formula*
S-8	SLO-1	*Problem solving using tutorial sheet 2.*	*Problem solving using tutorial sheet 5.*	*Problem solving using tutorial sheet 8.*	*Problem solving using tutorial sheet 11. Problems for Milne-Thomson Method.*	*Problem solving using tutorial sheet 14.*
	SLO-2					
S-9	SLO-1	*Solution of system of equations Iterative Method – Gauss- Jacobi method.*	*Newton's Divided difference formula.*	*More problems using Trapezoidal rule.*	*Application of Milne-Thomson Method.*	*Crank-Nicolson formula.*
	SLO-2	*Problems using Gauss-Jacobi method.*	*Problems by Newton's Divided difference formula.*	*More problems using Simpson's one third rule.*	*Adam's Bashforth method.*	*Crank-Nicolson formula.*
S-10	SLO-1	*Solution of system of equations Iterative Method – Gauss-Seidal method.*	*Additional problems by Newton's Divided difference formula.*	*More problems using Simpson's three eighth rule.*	*Problems using Adam's Bashforth method.*	*Crank-Nicolson formula.*
	SLO-2	*Problems using Gauss- Seidal method.*	*Lagrange's Interpolation formula.*	*Applications of Trapezoidal rule – Simpson's one third rule and Simpson's three eighth rules.*	*Application of Adam's Bashforth method.*	*Solution of Hyperbolic equations.*
S-11	SLO-1	*Power method.*	*Problems by Lagrange's Interpolation formula.*	*Application problems for Trapezoidal rule – Simpson's one third rule and Simpson's three eighth rules.*	*Additional problems for Milne-Thomson Method.*	*Solution of Hyperbolic equations by Explicit formula.*
	SLO-2	*Finding Eigen values by power method.*	*Inverse interpolation.*	*Applications problems for Trapezoidal rule – Simpson's one third rule and Simpson's three eighth rules.*	*Additional problems for Adam's Bash forth Method*	*More problems in Hyperbolic equations using Explicit formula.*
S-12	SLO-1	*Problem solving using tutorial sheet 3.*	*Problem solving using tutorial sheet 6.*	*Problem solving using tutorial sheet 9.*	*Problem solving using tutorial sheet 12.*	*Problem solving using tutorial sheet 15.*
	SLO-2	*Applications of numerical techniques to solve algebraic, transcendental and simultaneous equations*	*Application of interpolation for finding intermediate values of a well-known data*	*Applications of Numerical integration.*	*Applications of ordinary differential equation.*	*Applications of partial differential equation.*

Learning Resources	1. *B.S. Grewal, Numerical Methods in engineering and science, Khanna Publishers, 42nd edition, 2012* 2. *S.S. Sastry, Introductory Methods of Numerical Analysis, PHI, 4th edition, 2005* 3. *E. Balagurusamy, Computer Oriented Statistical and Numerical Methods – Tata McGraw Hill., 2000*	4. *M.K.Jain, SRK Iyengar and R.L.Jain, Numerical Methods for Scientific and Engineering Computation, Wiley Eastern Ltd., 4th edition, 2003* 5. *Dr. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co., 2005*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	*2. Dr. Nanjundan, Bangalore University, nanzundan@gmail.com*	*2. Dr. Sundarammal kesavan, SRMIST*

Course Code	18MAB301T	Course Name	PROBABILITY AND STATISTICS	Course Category	B	*Basic Sciences*	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*18MAB201T/18MAB203T*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Mathematics*	Data Book / Codes/Standards	*Statistical tables*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.*			
CLR-2 :	*To appropriately choose, define and/or derive probability distributions such as the Binomial, Poisson and Normal etc to model and solve engineering problems.*			
CLR-3 :	*To learn how to formulate and test hypotheses about mean, variance and proportion and to draw conclusions based on the results of statistical tests.*			
CLR-4 :	*To understand how regression analysis can be used to develop an equation that estimates how two variables are related and how the analysis of variance procedure can be used to determine if means of more than two populations are equal.*			
CLR-5 :	*To comprehend the fundamentals of quality control and the methods used to control systems and processes.*			
CLR-6 :	*To acquire the knowledge of probability and statistics and its applications to the respective branches of Engineering.*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*To gain the knowledge of probability concepts, to determine probabilities that help to solve engineering problems. and to determine the expectation and variance of a random variable from its distribution*	*3*	*85*	*80*	*M*	*H*	*L*						*M*	*L*		*H*			
CLO-2 :	*Gain familiarity in deriving probability distributions such as the Binomial, Poisson and Normal etc and apply them tn the problems involving Science and Engineering*	*3*	*85*	*80*	*M*	*H*		*M*	*M*				*M*			*H*			
CLO-3 :	*Acquire knowledge in formulating and testing hypotheses about means, variances and proportions*	*3*	*85*	*80*	*M*	*H*							*M*			*H*			
CLO-4 :	*To gain the knowledge in regression analysis and ANOVA and to apply them to solve problems in Engineering*	*3*	*85*	*80*	*M*	*H*	*L*	*M*					*M*	*L*		*H*			
CLO-5 :	*Understanding the concept and applications of statistical quality control charts in technology and industries*	*3*	*85*	*80*	*M*	*H*	*M*						*M*			*H*			
CLO-6 :	*To solve the problems based on probability and statistics in science and engineering*	*3*	*85*	*80*	*M*	*H*							*M*			*H*			

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*probability concepts, Types of Events*	*Discrete distributions*	*Sampling*	*Correlation and Properties*	*Introduction and Process Control*
	SLO-2	*Axioms and theorems*	*Binomial distribution*	*Small and large samples*	*Karl pearson's correlation coefficient*	*Types of Control charts*
S-2	SLO-1	*Conditional probability Baye's theorem – without proof*	*M.G.F*	*Hypothesis Testing*	*Spearman's rank correlation coefficient*	*Control charts for variables*
	SLO-2	*Applications- Baye's Theorem.*	*mean*	*Large sample test-Test of significance for single proportion*	*Problems on rank correlation –non repeated ranks*	*Control chart for attributes*
S-3	SLO-1	*Random variables – Discrete case*	*variance*	*Test of significance for difference of proportions*	*Problems on repeated ranks*	*Control limits and drawing conclusions*
	SLO-2	*Probability Mass function*	*Fitting binomial distribution*	*More problems on test 2*	*Linear Regression lines and Properties*	*Control chart for mean and range when* $\overline{X}$ *and R data given directly*
S-4	SLO-1	*Problem solving using tutorial sheet 1*	*Problem solving using tutorial sheet 4*	*Problem solving using tutorial sheet 7*	*Problem solving using tutorial sheet 10*	*Problem solving using tutorial sheet 13*

	SLO-2	*Problem solving using tutorial sheet 1*	*Problem solving using tutorial sheet 4*	*Problem solving using tutorial sheet 7*	*Applications of correlation in engineering*	*Problem solving using tutorial sheet 14*
S-5	SLO-1	*Cumulative distribution function*	*Poisson distribution*	*Test of significance for single mean*	*regression coefficient problems*	*More problems on* $\overline{X}$ *and R data given directly*
	SLO-2	*Mathematical expectation –discrete case*	*M.G.F, mean*	*Test of significance for difference of means*	*More problems on regression coefficients*	*Control chart for mean and range- when* $\overline{X}$ *and R data not given directly*
S-6	SLO-1	*Variance*	*variance*	*Small sample tests*	*Relation between correlation and regression*	*More problems on* $\overline{X}$ *and R data not given directly*
	SLO-2	*Probability density function*	*Fitting Poisson distribution*	*Student's t- test for single mean*	*problems on relation between correlation and regression*	*Control chart for mean and S.D when mean S.D values given directly*
S-7	SLO-1	*Cumulative distribution function*	*Geometric distribution-M.G.F, mean, variance*	*'t' test for the difference of means*	*Applications of regression in engineering*	*More problems on* $\overline{X}$ *and S*
	SLO-2	*Mathematical expectation-continuous case*	*Memory less property*	*More problems on t- test*	*Applications of regression in engineering*	*Control chart for mean and S.D when mean S.D values not given directly*
S-8	SLO-1	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 8*	*Problem solving using tutorial sheet 11*	*Problem solving using tutorial sheet 14*
	SLO-2	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 8*	*Problem solving using tutorial sheet 11*	*Problem solving using tutorial sheet 14*
S-9	SLO-1	*Variance*	*Continuous distribution:*	*Fisher's F-test*	*Introduction to ANOVA Analysis of Variance – One way Classification*	*More problems on* $\overline{X}$ *and S*
	SLO-2	*Raw Moments*	*Uniform distribution – MGF, Mean, Variance*	*Test of significance for two sample variances*	*Problems on one way classification*	*Control chart for attributes- np chart*
S-10	SLO-1	*Central Moments*	*Exponential distribution - MGF, Mean, Variance*	*Chi square test- for goodness of fit*	*More problems on one way classification*	*More problems on np-chart*
	SLO-2	*Moment generating function*	*Memory less property*	*Problems on goodness of fit*	*ANOVA – two way classification*	*p- chart*
S-11	SLO-1	*MGF- discrete random variable*	*Normal distribution*	*Chi square test- for independence of attributes*	*Problems on two way classification*	*More problems on p- chart*
	SLO-2	*MGF- continuous random variable*	*Problems on Normal distribution*	*More problems on Chi square test- for independence of attributes*	*More problems on two way classification*	*Control chart for the defects in a single unit- c- chart*
S-12	SLO-1	*Problem solving using tutorial sheet 3*	*Problem solving using tutorial sheet 6*	*Problem solving using tutorial sheet 9*	*Problem solving using tutorial sheet 12*	*Problem solving using tutorial sheet 15*
	SLO-2	*Applications of Probability and Random variables in Engineering field*	*Application of distributions in Engineering*	*Applications and the importance of sampling in various fields of engineering*	*Engineering Applications of ANOVA, Correlation and Regression*	*Engineering applications of control chart*

Learning Resources	1. *S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.* 2. *Johnson. R.A., Miller &Freund's, Probability and Statistics for Engineers, 6th Edition, Pearson's Education, New Delhi, 2000.* 3. *Veerarajan T., Probability and Statistics, Tata McGraw-Hill, New Delhi, 2010.*	4. *Devore (JL), Probability and Statistics, 5th Edition: For Engineering and the Sciences, 2000.* 5. *Vijay K. Rohatgi., A.K. Md. Ehsanes Saleh, An Introduction to Probability and Statistics, 2 Edition, Wiley, 2008*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40%	-	30%	-	30%	-	30%	-	30%	-
Level 2	Apply Analyze	40%	-	40%	-	40%	-	40%	-	40%	-

Level 3	Evaluate Create	20%	-	30%	-	30%	-	30%	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.V.Maheshwaran, CTS, Chennai, maheshwaranv@yahoo.com	*1. Dr.K.C.Sivakumar, IIT Madras, kcskumar@iitm.ac.in*	*1. Dr.A.Govindarajan, SRMIST*
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Course Code	18PYB102J	Course Name	PHYSICS: MECHANICS AND MECHANICS OF SOLIDS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	2	5

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Physics and Nanotechnology*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize the principles pertaining to vector mechanics*			
CLR-2 :	*Utilize the knowledge on rigid body mechanics*			
CLR-3 :	*Apply knowledge on statics*			
CLR-4 :	*Identify the theory of elasticity at a basic level*			
CLR-5 :	*Apply the concept of friction and its applications*			
CLR-6 :	*Utilize the concepts in physics for the understanding of engineering and technology*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify the principle of mechanics*	*2*	*80*	*70*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*Determine the resultants of force systems acting on rigid bodies*	*2*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Establish the equations of equilibrium for a rigid body*	*2*	*75*	*70*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Analyze the internal forces in engineering structures composed of simple trusses*	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Apply the concepts of stress and strain in different bodies*	*2*	*75*	*70*	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	*Apply the concepts of mechanics and mechanics of solids in real time applications*	*2*	*80*	*70*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	*Introduction to vector analysis*	*Definition and motion of a rigid body in the plane*	*Introduction to rigid body*	*Concept of stress at a point*	*Force analysis -axial force*
	SLO-2	*Scalar quantities & vector quantities*	*Rotation in the plane*	*Free body diagrams with examples*	*Planet stress*	*Force analysis -shear force, bending moment*
S-2	SLO-1	*Transformation of scalars and vectors*	*Kinematics in a coordinate system rotating in the plane*	*Reactions at Supports and connections for a two dimensional structure*	*Transformation of stresses at a point*	*Twisting moment diagrams of slender members*
	SLO-2	*Transformation of scalars and vectors under rotation transformation*	*Kinematics in a coordinate system translating in the plane*	*Examples on modeling of typical joints*	*Principal stresses and Mohr's circle*	*Twisting moment diagrams of slender members (without singularity function)*
S-3	SLO-1	*Forces in nature*	*Angular momentum about a point of a rigid body in planar motion*	*Equilibrium of a rigid body in two dimensions*	*Displacement field*	*Torsion of circular shafts- Definition of torsion, effects of torsion*
	SLO-2	*Newton's laws*	*Euler's laws of motion*	*Condition for equilibrium in two dimensions*	*Concept of strain at a point*	*Generation of shear stresses*
S-4	SLO-1	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S 5-6	SLO-1	*Basics of experimentation*	*Determine acceleration due to gravity- Compound bar pendulum*	*Determine Moment of inertia and angular acceleration with precision pivot bearing*	*Measurement of free fall-Dynamics method*	*Determine Young's modulus-non-uniform bending*
	SLO-2					
S-7	SLO-1	*Form invariance of Newton's second law*	*Independence of Euler's laws from Newton's laws*	*Equilibrium of a rigid body in three dimensions*	*Plane strain- transformation of strain at a point*	*Torsion of thin walled tubes*
	SLO-2	*Solving Newton's equations of motion in polar coordinates*	*Describing rigid body motion*	*Condition for equilibrium in three dimensions*	*Principal strains*	*Shear test by torsion of tube*
S-8	SLO-1	*Fundamentals of simple harmonic motion*	*Precession of a body*	*Friction- limiting cases*	*Mohr's circle*	*Moment-curvature relation in pure bending of beams with symmetric cross-section*
	SLO-2	*Harmonic oscillator*	*Precession of a spinning top*	*Friction- non limiting cases*	*Strain Rosettes*	*Moment-curvature relation in pure bending*

						of beams with symmetric cross-section
S-9	SLO-1	*Damped harmonic motion*	*Introduction to three-dimensional rigid body motion*	*Force-displacement relationship*	*Concepts of elasticity, plasticity*	*Bending stress, Shear stress*
	SLO-2	*Different cases-over critically and lightly damped oscillators*	*Distinction from two-dimensional motion*	*Simple illustration of force displacement*	*Strain hardening, work hardening*	*Cases of combined stresses*
S-10	SLO-1	*Solving problems*	*Solving problems*	*Solving problems*	*Solving problems*	*Solving problems*
	SLO-2	*Solving problems*	*Solving problems*	*Solving problems*	*Solving problems*	*Solving problems*
S 11-12	SLO-1	*Determine acceleration due to gravity using Bifilar pendulum*	*Determine spring constant-Expansion of a helical spring*	*Repeat/Revision of experiments*	*Determine rigidity modulus-Torsional pendulum*	*Determine Young's Modulus-Uniform Bending*
	SLO-2					
S-13	SLO-1	*Fundamentals of vibrations*	*Two- dimensional motion in terms of angular velocity vector, its rate of change*	*Geometric compatibility for small deformations*	*Failure of materials*	*Concept of strain energy*
	SLO-2	*Vibration model*	*Two- dimensional motion in terms of Moment of inertia tensor*	*Illustrations based on axially loaded members*	*Concepts of fracture and yielding*	*Yield criteria, Deflection due to bending*
S-14	SLO-1	*Forced oscillations*	*Three-dimensional motion of a rigid body - coplanar manner*	*Introduction to trusses*	*Idealization of one dimensional stress-strain curve*	*Deflection due to bending-integration of the moment*
	SLO-2	*Magnification factor of forced oscillations*	*Rod executing conical motion with center of mass fixed*	*Types of trusses*	*Generalized Hooke's law with thermal strains for isotropic materials*	*curvature relationship for simple boundary conditions*
S-15	SLO-1	*Resonance*	*Rod executing conical motion-two dimension and three dimension*	*Method of joints*	*Characteristics of elasticity*	*Integration of the moment-curvature relationship. Method of superposition*
	SLO-2	*Application of resonance*	*Failure of two-dimensional formulation*	*Method of section*	*Complete equations of elasticity*	*Strain energy and complementary strain energy for simple structural elements*
S-16	SLO-1	*Solving problems*	*Solving problem*	*Solving problem*	*Solving problem*	*Solving problem*
	SLO-2	*Solving problems*	*Solving problem*	*Solving problem*	*Solving problem*	*Solving problem*
S 17-18	SLO-1	*Newton's 2nd law-Demonstration track with measure Dynamics*	*Determine Static friction, sliding friction and rolling friction*	*Determine moment of inertia and angular acceleration- Gyroscope*	*Mechanical conservation of energy-Maxwell's wheel with measure Dynamics*	*Mini Project*
	SLO-2					

Learning Resources	*1.Mahendra K Verma, Introduction to Mechanics, Universities Press (India) Pvt. Ltd., 2016* *2.J. L. Meriam, Engineering Mechanics – Dynamics, 7th Edition, Vol. 2, Wiley Publishers, 2012*	*3.J. P. Den Hartog, Mechanics, Dover Publications Inc., 1961* *4.E.P. Popov, Engineering Mechanics of Solids, Prentice Hall India Learning Private Limited; 2nd Edition, 2002.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. D.K. Aswal, National Physical Laboratory, dkaswal@nplindia.org	*Prof. V. Subramaniam, IITM, Chennai, manianvs@iitm.ac.in*	*Dr. C. Preferencial Kala, SRMIST*
	Prof. C. Venkateswaran, Univ of Madras, venkateswaran@unom.ac.in	*Dr. M. Krishnamohan, SRMIST*

Course Code	18CYB101J	Course Name	CHEMISTRY	Course Category	B	Basic Sciences	L	T	P	C
							3	1	2	5

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards		*Periodic Table*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize the atomic and molecular manipulation towards the design of new materials*			
CLR-2 :	*Employ various spectroscopic techniques in identifying the structure and correlate it with their properties*			
CLR-3 :	*Exploit the periodic properties of elements for bulk property manipulation towards technological advancement*			
CLR-4 :	*Address concepts related to electrochemistry, such as corrosion, using thermodynamic principles*			
CLR-5 :	*Employ various organic reactions towards the design of fine chemical and drug molecules for industries*			
CLR-6 :	*Utilize the basic chemistry principles applied in various engineering problems and identify appropriate solutions*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Analyze atomic, molecular orbitals of organic, inorganic molecules to identify structure, bonding, molecular energy levels*	*2*	*70*	*65*	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*Utilize the principles of spectroscopic technique in analysing the structure and properties of molecules*	*2*	*80*	*70*	*H*	-	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Rationalize bulk properties using thermodynamic considerations and periodic properties of elements*	*2*	*75*	*60*	-	*H*	-		-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Utilize the concepts of thermodynamics in understanding thermodynamically driven chemical reactions*	*2*	*70*	*70*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Perceive the importance of stereochemistry in synthesizing organic molecules applied in pharmaceutical industries*	*2*	*80*	*70*	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	*Utilize concepts in chemistry for technological advancement based on electronic, atomic and molecular level modification*	*2*	*75*	*65*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	*Schrodinger equation- introduction*	*Crystal field theory-Explanation*	*surface characterization techniques – XPS - Introduction*	*Hard soft acids and bases*	*Optical activity, absolute configurations*
	SLO-2	*Schrodinger equation-Derivation*	*Crystal field theory-Explanation*	*surface characterization techniques – XPS - Explanation*	*Hard soft acids and bases*	*conformational analysis*
S-2	SLO-1	*Particle in a box solutions*	*Energy level diagrams for transition metal ions*	*Diffraction and scattering of solids*	*Thermodynamic functions: energy*	*Isomerism in transitional metal compounds-Introduction*
	SLO-2	*Applications for conjugated molecules*	*Energy level diagrams for transition metal ions*	*Explanation*	*Entropy and free energy*	*Isomerism in transitional metal compounds-Types*
S-3	SLO-1	*Forms of the hydrogen atom wave functions*	*Magnetic properties of transition compounds*	*Ionic, dipolar interactions*	*Estimation of entropy*	*Introduction to reactions involving substitution*
	SLO-2	*plots of these functions to explore their spatial variations*	*Magnetic properties of transition compounds*	*Van der Waals interactions*	*Estimation of free energies.*	*Addition reaction*
S-4	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S 5-6	SLO-1	*Lab Introduction*	*Estimate of amount of chloride content in a water sample.*	*Determine strength of a mixture of acetic and hydrochloric acid by conductometry.*	*Determine adsorption of oxalic/acetic acid from aqueous soln. by activated charcoal*	*Experiment - Repeat - 2*
	SLO-2					
S-7	SLO-1	*Molecular orbitals of diatomic molecules-Homonuclear*	*Principles of spectroscopy-Introduction*	*Equations of state of real gases*	*Free energy and emf. Cell potentials*	*Elimination reaction*
	SLO-2	*Heteronuclear diatomic molecules*	*Principles of spectroscopy-Explanation*	*critical phenomena*	*The Nernst equation and applications*	*Oxidation reaction*
S-8	SLO-1	*Equations for atomic orbitals*	*Selection rules-Introduction*	*Effective nuclear charge, penetration of orbitals*	*Acid base, oxidation reduction*	*Reduction reaction*
	SLO-2	*Equations for molecular orbitals*	*selection rules-Explanation*	*variations of s, p, d and f orbital energies of*	*Solubility equilibria*	*Examples*

				atoms in the periodic table		
S-9	SLO-1	*Energy level diagrams of diatomic-introduction*	*Electronic spectroscopy -Introduction*	*Electronic configurations, atomic and ionic sizes*	*Water chemistry*	*Cyclization*
	SLO-2	*Energy level diagrams of diatomic-explanation*	*Electronic spectroscopy-Explanation*	*Electronic configurations, atomic and ionic sizes*	*Water chemistry*	*Ring opening reactions*
S-10	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S 11-12	SLO-1	*Determine amount of sodium carbonate, sodium hydroxide in a mixture by titration*	*Determine strength of an acid using pH meter*	*Determine ferrous ion using potassium dichromate by potentiometric titration*	*Determine rate constant of Acid hydrolysis of an ester*	*Experiment - Repeat - 3*
	SLO-2					
S-13	SLO-1	*π-molecular orbitals of butadiene*	*Rotational spectroscopy of diatomic molecules*	*ionization energies, electron affinity and electronegativity*	*Corrosion*	*Synthesis of a commonly used drug molecule-Introduction*
	SLO-2	*π-molecular orbitals of benzene*	*Rotational spectroscopy of diatomic molecules*	*ionization energies, electron affinity and electronegativity*	*Corrosion*	*Synthesis of a commonly used drug molecule-Examples*
S-14	SLO-1	*Aromaticity-Introduction*	*Vibrational spectroscopy of diatomic molecules.*	*Polarizability, oxidation states*	*Representations of 3 dimensional structures*	*Synthesis of a commonly used drug molecule-Introduction*
	SLO-2	*Aromaticity-explanation*	*Applications of vibrational and rotational spectroscopy of diatomic molecule*	*Polarizability, oxidation states*	*structural isomers and stereoisomers*	*Synthesis of a commonly used drug molecule-Examples*
S-15	SLO-1	*Crystal field theory-Introduction*	*Nuclear magnetic resonance - Introduction*	*Coordination numbers and geometries*	*Configurations and symmetry and chirality*	*Question & Answer*
	SLO-2	*Crystal field theory-Introduction*	*Nuclear magnetic resonance - Explanation*	*Coordination numbers and geometries*	*enantiomers, diastereomers*	*Question & Answer*
S-16	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S 17-18	SLO-1	*Determine hardness (Ca^{2+}) of water using EDTA – complexometry method*	*Determine strength of an acid by conductometry*	*Determine molecular weight of a polymer by viscosity average method*	*Experiment - Repeat - 1*	*Demonstration Practical Session*
	SLO-2					

Learning Resources	*1. B. H. Mahan, R. J. Meyers, University Chemistry, 4th ed., Pearson publishers, 2009.* *2. M. J. Sienko, R. A. Plane, Chemistry: Principles and Applications, 3rd ed., McGraw-Hill publishers, 1980* *3. C. N. Banwell, Fundamentals of Molecular Spectroscopy, 5th ed., McGraw-Hill publishers, 2013*	*4. B. L. Tembe, Kamaluddin, M. S. Krishnan, Engineering Chemistry (NPTEL Web-book) http://nptel.ac.in/downloads/122101001/* *5. Peter W. Atkins, Julio de Paula, James Keeler, Physical Chemistry, 11th ed., Oxford publishers, 2018* *6. K. P. C. Vollhardt, N. E. Schore, Organic Chemistry: Structure and Function 7thed., Freeman, 2014*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	18EES102L	Course Name	ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP	Course Category	S	*Engineering Sciences*	L	T	P	C
							1	0	4	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Electrical and Electronics Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Design a layout of residential wiring and introduction to PV powered house*			
CLR-2 :	*Impart knowledge on measurements of various electrical quantities*			
CLR-3 :	*Gain knowledge on troubleshooting various electrical and electronic equipment*			
CLR-4 :	*Understand the basic working of Electrical machines, transformers*			
CLR-5 :	*Gain knowledge on fabrication of Printed Circuit Boards and IC fabrication*			
CLR-6 :	*Understand the basics of illumination and study the various components of Power System*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Comprehend the basics of residential wiring and understand the design of the solar system for small homes*	*1*	*85*	*80*	*H*	-	*H*	-	-	*H*	*H*	-	-	-	-	*H*	-	-	-
CLO-2 :	*Understand the measurement of the various electrical quantities (like voltage, current, power, power factor)*	*1*	*85*	*80*	*H*	-	*H*	-	*H*	*H*	*H*	-	*H*	-	-	*H*	-	-	-
CLO-3 :	*Gain knowledge on working and troubleshooting of various electrical and electronic circuits in real time application*	*1*	*85*	*80*	*H*	-	-	-	-	-	*H*	-	-	-	-	-	-	-	-
CLO-4 :	*Understand the constructional details and principle of operation of DC machines and Transformers*	*2*	*85*	*80*	*H*	-	-	-	-	-	*H*	-	-	-	-	-	-	-	-
CLO-5 :	*Familiarized with PCB design and fabrication process*	*2*	*85*	*80*	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	*Acquire knowledge on illumination and power system components*	*2*	*85*	*80*	*H*	-	-	-	-	-	*H*	-	-	-	-	-	-	-	-

		Wiring and Earthing	Solar Panels and Wiring	Electrical & Electronic Equipment	DC, AC Machines, PCB Design	Panels, 3D Printing
Duration (hour)		15	15	15	15	15
S-1	SLO-1	*I.E. rules for electrical wiring as per 2003 act.-Prepare Layout, load calculation*	*Wiring layout using simulation software*	*Measurement of energy*	*Principles of DC machines*	*Illumination concepts*
	SLO-2	*Estimation and costing of domestic installation. (Residential, lab, hall etc.,)*	*Examples of Wiring*	*Single-phase and Three-phase energy meter*	*Principles of AC machines*	*lighting calculation*
S 2-5	SLO-1	*Lab 1: Residential Wiring: Energy meter, fuses, switches, indicator, lamps, etc.,*	*Lab 4: Design of Wiring layout using simulation software*	*Lab 7: Measurement of energy using single-phase, three-phase energy meter*	*Lab 10: DC machine: commutator, brush AC: induction-squirrel cage, synchronous*	*Lab 4: Experiment and test: inverse square law of illumination, photometer experiment*
	SLO-2					
S-6	SLO-1	*Types of wiring: fluorescent lamp wiring*	*Study of PV cells characteristics (series, parallel connections, partial shading, etc.,)*	*Troubleshooting electrical equipment: fan, iron box*	*Assembly of choke*	*Power system components: Circuit Breakers, switchgears*
	SLO-2	*Staircase, godown wiring*	*Design of PV system*	*Troubleshooting electrical equipment: mixer and grinder*	*Small transformer and winding of machines*	*Control panel, relays*
S 7-10	SLO-1	*Lab 2: Wiring: fluorescent lamp, stair case, godown wiring etc.,*	*Lab 5: Design of Solar system for small houses*	*Lab 8: Troubleshooting of equipment: fan, iron-box, mixer, grinder*	*Lab 11: Assembly of choke, transformer and winding practices in electrical machines*	*Lab 5: Design of control panels*
	SLO-2					
S-11	SLO-1	*Study of Earthing*	*Measurement of electrical quantities: voltage, current,*	*Electronic components: active & passive, Electronic Instruments: CRO*	*PCB Design*	*3D Printing and its components*
	SLO-2	*Measurement of Earth resistance.*	*Power, Power factor in RLC circuits)*	*Function generator, Power Supply, Multi-meter, IC tester and Solder practice*	*PCB Fabrication*	*Advantages and Uses of 3D printing*
S 12-15	SLO-1	*Lab 3: Study of Earthing and Measurement to Earth resistance.*	*Lab 6: Measurement of electrical voltage, current, power, power factor*	*Lab 9: Trouble shooting of electronic circuits and Soldering practices*	*Lab 12: PCB Design and fabrication*	*Lab 6: 3D Printing demonstration*
	SLO-2					

Learning Resources	1. Subhransu Sekhar Dash & K. Vijayakumar, Electrical Engineering Practice Lab Manual. Vijay Nicole, 2013	2. Laboratory Manual for Electrical and Electronic Engineering Practices, SRMIST

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Understand										
Level 2	Apply	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. S. Paramasivam, Danfoss, Industries Pvt Ltd., paramsathya@yahoo.com	*1. Dr. K. S. Swarup, IIT Madras, ksswarup@iitm.ac.in*	*1. Dr. K. Vijayakumar, SRMIST*
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	*2. Dr. Rajeev Sukumaran, IIT Madras, rajeev@wmail.iitm.ac.in*	*2. Dr. S. S. Dash, SRMIST*

Course Code	18CSS101J	Course Name	PROGRAMMING FOR PROBLEM SOLVING	Course Category	S	*Engineering Sciences*	L	T	P	C
							3	0	4	5

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Computer Science and Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Think and evolve a logically to construct an algorithm into a flowchart and a pseudocode that can be programmed*
CLR-2 :	*Utilize the logical operators and expressions to solve problems in engineering and real-time*
CLR-3 :	*Store and retrieve data in a single and multidimensional array*
CLR-4 :	*Utilize custom designed functions that can be used to perform tasks and can be repeatedly used in any application*
CLR-5 :	*Create storage constructs using structure and unions. Create and Utilize files to store and retrieve information*
CLR-6 :	*Create a logical mindset to solve various engineering applications using programming constructs in C*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify methods to solve a problem through computer programming. List the basic data types and variables in C*	*2*	*85*	*80*	*L*	*H*	*H*	*H*	*H*	-	-	*M*	*M*	*L*	-	*H*	-	-	-
CLO-2 :	*Apply the logic operators and expressions. Use loop constructs and recursion. Use array to store and retrieve data*	*3*	*85*	*80*	*L*	*H*	*H*	*H*	*H*	-	-	*M*	*M*	*L*	-	*H*	-	-	-
CLO-3 :	*Analyze programs that need storage and form single and multi-dimensional arrays. Use preprocessor constructs in C*	*3*	*85*	*80*	*L*	*H*	*H*	*H*	*H*	-	-	*M*	*M*	*L*	-	*H*	-	-	-
CLO-4 :	*Create user defined functions for mathematical and other logical operations. Use pointer to address memory and data*	*3*	*85*	*80*	*L*	*H*	*H*	*H*	*H*	-	-	*M*	*M*	*L*	-	*H*	-	-	-
CLO-5 :	*Create structures and unions to represent data constructs. Use files to store and retrieve data*	*3*	*85*	*80*	*L*	*H*	*H*	*H*	*H*	-	-	*M*	*M*	*L*	-	*H*	-	-	-
CLO-6 :	*Apply programming concepts to solve problems. Learn about how C programming can be effectively used for solutions*	*3*	*85*	*80*	*L*	*H*	*H*	*H*	*H*	-	-	*M*	*M*	*L*	-	*H*	-	-	-

Duration (hour)		21	21	21	21	21
S-1	SLO-1	*Evolution of Programming & Languages*	*Relational and logical Operators*	*Initializing and Accessing 2D Array*	*Passing Array Element to Function*	*Initializing Structure, Declaring structure variable*
	SLO-2	*Problem solving through programming*	*Condition Operators, Operator Precedence*	*Initializing Multidimensional Array*	*Formal and Actual Parameters*	*Structure using typedef, Accessing members*
S-2	SLO-1	*Creating algorithms*	*Expressions with pre / post increment operator*	*Array Programs – 2D*	*Advantages of using Functions*	*Nested structure* *Accessing elements in a structure array*
	SLO-2	*Drawing flowcharts*	*Expression with conditional and assignment operators*	*Array Contiguous Memory*	*Processor Directives and #define Directives*	*Array of structure* *Accessing elements in a structure array*
S-3	SLO-1	*Writing pseudocode*	*If statement in expression*	*Array Advantages and Limitations*	*Nested Preprocessor Macro*	*Passing Array of structure to function*
	SLO-2	*Evolution of C language, its usage history*	*L value and R value in expression*	*Array construction for real-time application* *Common Programming errors*	*Advantages of using Functions*	*Array of pointers to structures*
S 4-7	SLO-1 SLO-2	*Lab 1: Algorithm, Flow Chart, Pseudocode*	*Lab 4: Operators and Expressions*	*Lab 7: Arrays - Multidimensional*	*Lab 10: Functions*	*Lab 13: Structures & Unions*
S-8	SLO-1	*Input and output functions: Printf and scanf*	*Control Statements – if and else*	*String Basics*	*Pointers and address operator*	*Bit Manipulation to structure and Pointer to structure*
	SLO-2	*Variables and identifiers*	*else if and nested if, switch case*	*String Declaration and Initialization*	*Size of Pointer Variable and Pointer Operator*	*Union Basic and declaration*
S-9	SLO-1	*Expressions*	*Iterations, Conditional and Unconditional branching*	*String Functions: gets(), puts(), getchar(), putchar(), printf()*	*Pointer Declaration and dereferencing pointers*	*Accessing Union Members Pointers to Union*

	SLO-2	*Single line and multiline comments*	*For loop*	*String Functions: atoi, strlen, strcat, strcmp*	*Void Pointers and size of Void Pointers*	*Dynamic memory allocation, mallaoc, realloc, free*
S-10	SLO-1	*Constants, Keywords*	*While loop*	*String Functions: sprint, sscanf, strrev, strcpy, strstr, strtok*	*Arithmetic Operations*	*Allocating Dynamic Array*
	SLO-2	*Values, Names, Scope, Binding, Storage Classes*	*do while, goto, break, continue*	*Arithmetic Characters on Strings*	*Incrementing Pointers*	*Multidimensional array using dynamic memory allocation.*
S 11-14	SLO-1 SLO-2	*Lab 2: Input and Output Statements*	*Lab 5: Control Statements*	*Lab 8: Strings*	*Lab 11: Pointers*	*Lab 14: Structures & Unions*
S-15	SLO-1	*Numeric Data types: integer*	*Array Basic and Types*	*Functions declaration and definition*	*Constant Pointers*	*file: opening, defining, closing, File Modes, File Types*
	SLO-2	*Numeric Data types: floating point*	*Array Initialization and Declaration*	*Types: Call by Value, Call by Reference*	*Pointers to array elements and strings*	*Writing contents into a file*
S-16	SLO-1	*Non-Numeric Data types: char and string*	*Initialization: one Dimensional Array*	*Function with and without Arguments and no Return Values*	*Function Pointers*	*Reading file contents*
	SLO-2	*Increment and decrement operator*	*Accessing, Indexing one Dimensional Array Operations*	*Function with and without Arguments and Return Values*	*Array of Function Pointers*	*Appending an existing file*
S-17	SLO-1	*Comma, Arrow and Assignment operator*	*One Dimensional Array operations*	*Passing Array to Functions with return type*	*Accessing Array of Function Pointers*	*File permissions and rights*
	SLO-2	*Bitwise and Sizeof operator*	*Array Programs – 1D*	*Recursion Functions*	*Null Pointers*	*Changing permissions and rights*
S 18-21	SLO-1 SLO-2	*Lab 3: Data Types*	*Lab 6: Arrays – One Dimensional*	*Lab 9: Functions*	*Lab 12: Pointers*	*Lab 15: File Handling*

Learning Resources	*1. Zed A Shaw, Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C), Addison Wesley, 2015* *2. W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd ed. Prentice Hall, 1996*	*3. Bharat Kinariwala, Tep Dobry, Programming in C, eBook* *4. http://www.c4learn.com/learn-c-programming-language/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sainarayanan Gopalakrishnan, HCL Technologies, sai.jgk@gmail.com	*1. Prof. Janakiram D, IIT Madras, djram@iitm.ac.in*	*1. Dr. Christhu Raj M R, SRMIST*
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	*2. Dr. Rajeev Sukumaran, IIT Madras, rajeev@wmail.iitm.ac.in*	*2. Dr. B. Amutha, SRMIST*

Course Code	18MES101L	Course Name	ENGINEERING GRAPHICS AND DESIGN	Course Category	S	*Engineering Sciences*	L	T	P	C
							1	0	4	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Mechanical Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize engineering graphic fundamentals. apply the same to draw/evaluate engineering curves and projection of objects*			
CLR-2 :	*Draw projection of solid objects like prisms, cylinders, pyramids and cones used in various engineering objects*			
CLR-3 :	*Draw the projection of combination of solids, and section of solids. Create building plans for construction*			
CLR-4 :	*Create 3D part models. Develop its surfaces using solid-modeling software for effectiveness, clarity, accuracy, portability*			
CLR-5 :	*Evaluate the assembly of engineering component parts. Create 2D drawings for assembly of engineering components*			
CLR-6 :	*Draw, Create, Evaluate, Interpret engineering 2D and 3D surfaces of engineering components using modeling software*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - I	PSO - II	PSO – III
CLO-1 :	*Identify engineering graphics. Draw objects like points, lines, planes, and solids in perspective & orthographic projections*	*3*	*90*	*85*	*H*	*H*	*L*	*L*	*L*	*H*	*L*	*H*	*L*	*H*	*L*	*L*	*L*	*L*	*L*
CLO-2 :	*Draw projection of solids like prism, cylinder, pyramid and cone inclined in general positions, obtain auxiliary views*	*2*	*95*	*90*	*M*	*M*	*L*	*L*	*M*	*H*	*H*	*L*	*L*	*H*	*L*	*L*	*L*	*L*	*L*
CLO-3 :	*Draw projection of combination of solids made out of primitives, draw the section of solids, create building plans*	*3*	*90*	*85*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*M*	*H*	*L*	*H*	*L*	*L*	*L*
CLO-4 :	*Create 3D part models. Develop its surfaces with solid modeling software for effectiveness, clarity, accuracy, portability*	*3*	*90*	*85*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*L*	*H*	*H*	*L*	*H*	*M*	*L*	*M*
CLO-5 :	*Evaluate the assembly of parts including interference of parts. Create 2D drawings of assembly of parts*	*3*	*85*	*80*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*L*	*H*	*L*	*H*	*L*	*M*	*L*
CLO-6 :	*Draw graphics of engineering pans with point, line, plane, solids, in perspective and orthographic projections*	*2*	*90*	*85*	*M*	*M*	*L*	*M*	*L*	*L*	*L*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*

		Engineering graphics and Projection	Projection of solids using CAD software	Projections of combination of solids	Part Modeling and Drawing	Assembly Modeling and Drawing
Duration (hour)		15	15	15	15	15
S-1	SLO-1	*Principles, Standards, Conventions*	*Introducing CAD Software, layers, dimensions, tolerance, annotations*	*Combinations of solids, Constructive Solid Geometry(CSG), Boolean operations*	*3D modelling, parametric, non- parametric, parts of CSG, surface, wireframe, shaded*	*Part/ component model creation for assembly.*
	SLO-2	*Angle Projection, Symbols, Dimensions*	*Create, modify, customize, print using CAD*	*Creating combination of solids, isometric, perspective views, shaded, wire-frame*	*Rendered models, background, shadows, multi-view, isometric, perspective views*	*Study of various widely used assembly of parts like flanged joint, universal joint etc.*
S-2	SLO-1	*2D Geometric Constructions*	*Demo: Menu, Toolbars, Drawing Area, Dialog box, windows, Shortcut menus*	*Constructive Solid Geometry, Boolean operations, Creating combination of solids*	*3D modelling, parametric, non- parametric, parts of CSG, surface, wireframe, shaded*	*Creation of parametric parts for assembly*
	SLO-2	*2D Geometric Constructions*	*Command Line, Status Bar, Different zoom methods, Create, Select, Erase objects*	*isometric, perspective, shaded, wire-frame*	*Rendered models, background, shadows, multi-view, isometric, perspective views*	*non- parametric parts for assembly*
S-3	SLO-1	*Conic Curves ellipse by eccentricity method*	*Draw straight lines, rectangle, polar, absolute, relative*	*Constructive Solid Geometry, Boolean operations, Creating combination of solids*	*Viewing models in multi-view, isometric, and perspective views*	*Creation of parametric parts for assembly*
	SLO-2	*Conic Curves ellipse by eccentricity method*	*Orthographic constraints, Ortho ON, snap to objects manually, automatically*	*isometric, perspective, shaded, wire-frame*	*Viewing models in multi-view, isometric, and perspective views*	*non- parametric parts for assembly*
S-4	SLO-1	*Cycloids, Epicycloids*	*drawing lines, arcs, circles, polygons, create, edit, use layers, extend lines*	*Constructive Solid Geometry, Boolean operations, Creating combination of solids*	*Modelling industrial part drawings*	*Creation of parametric parts for assembly*
	SLO-2	*Hypocycloid*	*Dimensioning objects, annotations*	*isometric, perspective, shaded, wire-frame*	*Modelling industrial part drawings*	*non- parametric parts for assembly*
S-5	SLO-1	*Involute of a Square, Circle*	*Demo: drawing page, print, units/ scale/ limits settings, standards for dimensioning*	*Constructive Solid Geometry, Boolean operations, Creating combination of solids*	*Design new components as a team*	*Creation of parametric parts for assembly*
	SLO-2	*Spirals*	*ISO, ANSI Std. dimensioning, tolerancing*	*isometric, perspective, shaded, wire-frame*	*Design new components as a team*	*non- parametric parts for assembly*
S-6	SLO-1	*Introduction to perspective projection with terminologies and concepts*	*Projection of solid prisms and cylinders inclined to both the planes*	*Section of right regular solid with axis perpendicular to one principal planes and*	*3D Part to 2D Drawings geometric dimensioning and tolerancing annotations*	*Simple assembly of parts,*

	SLO-2	*Orthographic multiview and isometric projection*	*change of position method, reference line method / auxiliary projections,*	*cutting plane perpendicular to any one principle plane true shape of the section*	*generating 2D from 3D models, printing drawings, generating sectional views*	*associated part and assembly*
S-7	SLO-1	*Perspective projection of a point, line*	*Projection of solid prisms and cylinders inclined to both the planes*	*Section of right regular solid with axis perpendicular to one principal planes and*	*Geometric dimensioning and tolerancing annotations*	*Simple assembly of parts,*
	SLO-2	*Perspective projection of a planes, solids*	*Change of position method*	*cutting plane perpendicular to any one principle plane true shape of the section*	*Geometric dimensioning and tolerancing annotations*	*associated part and assembly*
S-8	SLO-1	*Orthographic multiview of point, line*	*Projection of solid prisms and cylinders inclined to both the planes*	*Section of right regular solid with axis perpendicular to one principal planes and cutting plane perpendicular to any one principle plane true shape of the section*	*Generating 2D drawings from 3D models*	*Simple assembly of parts,*
	SLO-2	*Orthographic multiview of planes, solids*	*Reference line method*		*Generating 2D drawings from 3D models*	*associated part and assembly*
S-9	SLO-1	*Isometric projection of a point, line*	*Auxiliary projections*	*Section of solids with axis inclined to both the planes and cutting plane perpendicular to any one principal plane only.*	*Generating sectional views*	*Simple assembly of parts,*
	SLO-2	*Isometric projection of planes, solids*	*Auxiliary projections*		*Generating sectional views*	*associated part and assembly*
S-10	SLO-1	*Isometric to orthographic multiview sketching*	*Viewing isometric and perspective views, shaded, wire-frame models*	*Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.*	*Printing drawings to printer or as .pdf*	*Simple assembly of parts,*
	SLO-2	*Orthographic multiview to isometric sketch*	*Oblique prismatic solids and its projections*		*Printing drawings to printer or as .pdf*	*associated part and assembly*
S-11	SLO-1	*Orthographic multiview projection of lines inclined to both planes*	*Projection of solid pyramids and cones inclined to both the planes*	*Building/ Dwelling drawing, Terminology, conventions, sectional plan and side-view of Building/ dwelling, include windows, doors, fixtures,*	*Development of surfaces: un-cut, & cut right / oblique regular solids*	*Assembly Drawings: exploded view with assembly annotations part details*
	SLO-2	*Orthographic multiview projection of planes inclined to planes, auxiliary projection*	*change of position method and reference line method / auxiliary projections,*		*Simple position with cutting planes perpendicular to any one principal plane*	*Printing assembly drawings to printer and as pdf*
S-12	SLO-1	*Projection of lines inclined to both the planes*	*Projection of solid pyramids and cones inclined to both the planes*	*Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.*	*Development of surfaces: un-cut, & cut right / oblique regular solids*	*Exploded view with assembly annotations*
	SLO-2	*true length, true inclinations, traces of lines*	*Change of position method*		*Simple position with cutting planes perpendicular to any one principal plane*	*part details*
S-13	SLO-1	*Projection of lines inclined to both the planes*	*Projection of solid pyramids and cones inclined to both the planes*	*Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.*	*Development of surfaces: un-cut, & cut right / oblique regular solids*	*Exploded view with assembly annotations*
	SLO-2	*true length, true inclinations, traces of lines*	*Change of reference line method*		*Simple position with cutting planes perpendicular to any one principal plane*	*part details*
S-14	SLO-1	*Finding shortest distance between a point and a plane*	*Auxiliary projections*	*Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.*	*Design of real time surface-development*	*Exploded view with assembly annotations*
	SLO-2	*Shortest distance between two lines*	*Auxiliary projections*		*Design of real time surface-development*	*part details*
S-15	SLO-1	*shortest distance between point and plane*	*Viewing isometric and perspective views, shaded, wire-frame models*	*Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.*	*Design of real time surface-development*	*Printing assembly drawings*
	SLO-2	*shortest distance between point and plane*	*Oblique pyramidal solids and projections*		*Design of real time surface-development*	*Printing assembly drawings*

Learning Resources	*1. Bhatt, N.D., Engineering Drawing (First Angle Projection),53rd ed., Charotar Publishing House, 2017* *2. Bethunc, J., Engineering Graphics with AutoCAD 2017, Pearson Education, 2016* *3. Khristofor Artemyevich Arustamov, Problems in projective geometry, MIR Publishers, Moscow, 1972* *4. Natarajan, K.V., A Text Book of Engineering Graphics, 21st Edition, Dhanalakshmi Pub., 2012* *5. Shah. M. B.,Rana, B. C, Engineering Drawing, Pearson Education, Pvt. Ltd., 2005* *6. Jeyapoovan. T., Engineering Drawing and Graphics using AutoCAD, Vikas Pub. House, 2015*	*7. Narayanan, K. L., Kannaiah, V., Engineering Graphics, Scitech Publications,2010* *8. Luzzader, Warren J., Duff John M., Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Prentice Hall of India Pvt. Ltd,, 2005.* *9. Mohammad Dastbaz, Chris Gorse, Alice Moncaster (eds.), Building Information Modelling, Building Performance, Design and Smart Construction, Springer 2017* *10. User Manual of Respective CAD Softwares*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Understand										
Level 2	Apply	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Dr. R. Kalimuthu, ISRO,	*1. Dr. Ramkumar P, IIT Madras, ramkumar@iitm.ac.in*	*1. Mr. D. Kumaran, SRMIST*
2.Dr. A. Velayutham, DRDO,	*2. Dr. Sourav Rakshit, IIT Madras, srakshit@iitm.ac.in*	*2. Mr. S. Balamurugan, SRMIST*

Note: For all B.Tech Programmes other than Civil, Mechanical, Automobile, Aerospace and Mechatronics, the entire course would be conducted using CAD Software only.

Course Code	18MES102J	Course Name	BASIC CIVIL AND MECHANICAL ENGINEERING	Course Category	S	*Engineering Sciences*	L	T	P	C
							3	1	2	5

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering & Mechanical Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Learn about building materials and identify the components of a building*			
CLR-2 :	*Know the Transportation system, bridges and dams*			
CLR-3 :	*Learn about Water supply system, solid waste management and Surveying. Know the working of IC engines and identify the sub system requirements*			
CLR-4 :	*Apply the concept of harnessing energy from various energy sources*			
CLR-5 :	*Apply manufacturing processes; casting, forming. List machining operations; lathe, drilling. Identify process of welding*			
CLR-6 :	*Utilize the basic civil and mechanical engineering knowledge for a broader perspective of engineering around us*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Characterize building materials and its applications*	*1*	*90*	*85*	*H*	-	*L*	*H*	*H*	*H*	*M*	-	-	-	-	*H*	-	-	-
CLO-2 :	*Understand the building components and its applications*	*1*	*90*	*85*	*H*	*M*	*M*	*M*	*H*	*H*	*M*	-	*H*	-	-	*H*	-	-	-
CLO-3 :	*Identify different transportation systems, water and waste water treatment and its applications Identify the working of IC engines and understand the need of various auxiliary systems*	*1*	*90*	*85*	*H*	*M*	*M*	*M*	*H*	*H*	*H*	*H*	*L*	*L*	*H*	*M*	*M*	*L*	*M*
CLO-4 :	*List the basic components and analyze the working of major power plants*	*2*	*90*	*85*	*H*	*L*	*L*	*L*	*L*	*M*	*H*	*L*	*L*	*L*	*L*	*M*	*M*	*L*	*M*
CLO-5 :	*Identify manufacturing processes; casting, forming. List machining operations; lathe, drilling. Identify process of welding*	*2*	*90*	*85*	*H*	*L*	*M*	*L*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*M*	*L*	*M*
CLO-6 :	*Apply the basic knowledge of civil and mechanical engineering*	*2*	*90*	*85*	*H*	*L*	*L*	*L*	*L*	*M*	*H*	*L*	*L*	*L*	*L*	*M*	*M*	*L*	*M*

		Building Materials, Foundations	*Civil Engineering Constructions*	*Waste Management, IC Engines*	*Power Plants*	*Manufacturing Processes*
Duration (hour)		18	18	18	18	18
S-1	SLO-1	*Introduction to Civil Engineering, Building Materials, History*	*Cement concrete flooring, Mosaic Flooring, Marble flooring*	*Disinfection of water and its methods.*	*Coal based thermal Power Plant: layout, components description*	*Casting introduction and history Expendable mold casting process*
	SLO-2	*Disciplines in Civil Engineering, Early constructions and development over time*	*Terrazzo flooring, Granite flooring, Ceramic tile flooring*	*Water distribution system and methods*	*Coal based thermal Power Plant: working, advantages, disadvantages*	*Production steps in a typical sand-casting process, terms including patterns and core*
S-2	SLO-1	*Ancient Monuments: Peruvudaiyar or Brihadeeswarar Temple, Kallanai dam*	*Roofs: Types of roofs, madras terrace roof*	*Sewage collection, treatment, disposal*	*Hydro Electric power plant: layout, components description*	*Other expendable mold casting: shell molding, vacuum molding*
	SLO-2	*Grand Anicut, Taj Mahal, Golconda fort, Angkor Wat, Pyramids of Giza, Colosseum*	*Reinforced concrete roofs, pitched roof, trussed roof*	*Methods of collection, sewerage systems*	*Hydro Electric power plant: working, advantages and disadvantages*	*expanded polystyrene process, Investment casting*
S-3	SLO-1	*Building Materials - Stone – Classification of Rocks,*	*Roof coverings: classification, types*	*Septic tank, principle*	*Nuclear power plant: Nuclear fission and fusion reactions*	*Metal forming, forging*
	SLO-2	*Quarrying, Dressing, Properties and Uses of Stone*	*Weathering course: Classification, Types*	*Working and construction details*	*Nuclear reactor, components description*	*Rolling, extrusion, drawing*
S-4	SLO-1	*Tutorial 1 : Pictures of Ancient Monuments and their Pictures*	*Tutorial 4: Flooring and roof coverings available in market*	*Tutorial 7: Water distribution system*	*Tutorial 10: Comparison of different Power Plants*	*Tutorial 13: Casting Processes*
	SLO-2					

S 5-6	SLO-1 SLO-2	*Lab 1: Learn the Building Materials and Properties (Strength of Materials Lab)*	*Lab 4: Learn types of floors and roofs (Structural Engineering Lab)*	*Lab 7: Site Visit: Sewage treatment plant*	*Lab 10: Site Visit: Power Producing Plant*	*Lab 13: Basic Lathe operation: facing, turning, step turning*
S-7	SLO-1	*Mortar, Plain and Reinforced Cement*	*Stress and strain, types*	*Solid waste management: Sources and types of solid waste*	*Layout, working, merits and demerits of boiling water reactor*	*Sheet metal working, applications. Cutting operations: shearing, blanking, punching,*
	SLO-2	*Concrete Grade and properties and uses*	*Stress & strain curve for mild steel*	*Sources and types of solid waste*	*Layout, working, merits and demerits of pressurized water reactor*	*cutoff, parting, slotting, perforating, notching, trimming, shaving, fine blanking*
S-8	SLO-1	*Special Concretes*	*Three moduli of elasticity, poisson's ratio,*	*Solid waste: Collection*	*Gas turbine power plants: components description*	*Material removal processes: Conventional lathe with its main components*
	SLO-2	*Fiber reinforced concrete and Ferro cement, Pre-stressed concrete*	*Ductility, stiffness, simple problems*	*Solid waste: Transfer and Disposal.*	*Working and types gas turbines, methods to improve performance*	*three and four-jaw chuck, tool and work holding devices*
S-9	SLO-1	*Construction chemicals*	*Transportation: Introduction, classification, Highways: design elements, cross section*	*Surveying, Levelling: Objectives*	*Layout and working of open cycle and closed cycle plants*	*Lathe operations: facing, turning*
	SLO-2	*Recycling: construction, demolition wastes*	*Classification of Roads, Administrative and Structural*	*Classifications of Surveying, Instruments used*	*Plants with inter-cooling, reheating and regeneration*	*drilling, boring and thread cutting*
S-10	SLO-1 SLO-2	*Tutorial 2 : Identify various fibers and construction chemicals used in market*	*Tutorial 5: Three Moduli problems*	*IC Engine: Classification, Comparisons Engine operations: 2 stroke & 4 stroke*	*Tutorial 11: Layout of a Power Plant*	*Tutorial 14: Lathe operations*
S 11-12	SLO-1 SLO-2	*Lab 2: Learning Building Materials Properties (Concrete & Highway Lab)*	*Lab 5: Stress & Strain Curve for Mild steel (Strength of Materials Lab)*	*Lab 8 Study of two stroke and four stroke cycle engines,*	*Lab 11: Practical study of mold, molding and casting processes*	*Lab 14: Lathe operation: Taper turning, grooving, thread cutting*
S-13	SLO-1	*Buildings, Classification of Buildings, Selection of site for a building*	*Railways – Zone and Headquarters, permanent way and its requirement*	*Comparison of SI & CI engines, Numerical Problems*	*Solar Thermal power plant: layout of Flat plate collector based plant*	*Overview of radial drilling machine with its main components*
	SLO-2	*Components of Buildings, Soil, General types of soil, Classification*	*Bridges: Components of bridge, classification, types, structure*	*Engine starting system: battery ignition system, Magneto ignition system*	*Solar Thermal power plant: central receiver type plant, advantages, disadvantages*	*Overview of upright drilling machine with its main components*
S-14	SLO-1	*Bearing Capacity, Factors affecting bearing capacity, Methods to improve*	*Dams: Purpose, Classification, Selection of Site, Gravity, Advantages, Limitations*	*Fuel supply systems of SI Engine : working of carburettor*	*Wind energy conversion system – wind turbine types*	*Metal joining process-welding, types*
	SLO-2	*Foundations: Functions, General types of foundation, Shallow foundations*	*Water supply system, Per capita demand, Factors affecting, Sources of water supply*	*Fuel supply systems of CI Engine: fuel injector, working of Common Rail Diesel Injection*	*Working, advantages and disadvantages*	*Welding equipment, tools and accessories*
S-15	SLO-1	*Deep Foundations*	*Water Treatment: Standards of Drinking water, Layout of treatment plant*	*Lubrication systems: Functions, working of mist and forced feed lubrication system*	*Ocean Thermal Energy Conversion system: layout of open cycle*	*Types of weld joints: butt, corner, lap, tee, edge joint*
	SLO-2	*Machine Foundations*	*Treatment plant, Slow Sand filter, Rapid Sand filter*	*Cooling Systems: Air and Water Cooled Engines*	*Layout of closed cycle, advantages, disadvantages*	*Types of welds: fillet, groove, plug, spot, seam weld*
S-16	SLO-1 SLO-2	*Tutorial 3: Making model for Building Components*	*Tutorial 6: Model making - Sand Filters*	*Tutorial 9: Alternate fuels for IC Engines Properties, Limitations, Emission Standards*	*Tutorial 12: Energy Conversion Methods*	*Tutorial 15: Metal Joining Processes*
S 17-18	SLO-1 SLO-2	*Lab 3: learn different types of Soils and Foundations (Soil Mechanics Lab)*	*Lab 6: Water standards and treatment methods (Environment Lab)*	*Lab 9: Practical study of I.C engine auxiliary system components*	*Lab 12: Casting operation: pattern and core*	*Lab 15: Drilling, boring, counter boring, counter sinking, reaming, tapping*

Learning Resources	*1. Rangwala .S.C, Engineering Materials, Charotar Publishing House, Anand, 2012* *2. Patil, B.S. Legal Aspects of Building and Engineering Contract, 1974* *3. Raju K.V.B, Ravichandran P.T, Basics of Civil Engineering, Ayyappa Publications, Chennai, 2012* *4. M.S. Shetty, Concrete Technology, S.Chand Publications, 2006* *5. Howard S Peavy, Donald R Rowe, George Tchobanoglous, Environmental Engineering, McGraw-Hil, 1985*	*6. Serope Kalpakjian, Steven Schmid, Manufacturing Processes for Engineering Materials, Pearson, 2016* *7. Drbal, Larry F. Boston, Patricia G. Westra, Kayla L. Black, Veatch, Power Plant Engineering, Kluwer, 1995* *8. Andy Walker, "Solar Energy", John Wiley & Sons, 2013* *9. John B. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education, 2017* *10. Kumar. T, Leenus Jesu Martin, Murali. G, Basic Mechanical Engineering, Suma Publications, 2007*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Vivekabhayankar, Afcons, vivek.abhyankar@afcons.com	*1. Dr. K, Ramamurthy, IIT Madras, vivek@iitm.ac.in*	*1. Mr. S. Pradeep, SRMIST*
2. Dr. R. Kalimuthu, ISRO	*2. Dr. Sourav Rakshit, IIT Madras, srakshit@iitm.ac.in*	*2. Dr. K. Suresh Kumar, SRMIST*

Course Code	18PDH102T	Course Name	MANAGEMENT PRINCIPLES FOR ENGINEERS	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Acquire knowledge about the fundamental concepts of organization and management			
CLR-2 :	Make decision strategies, planning process, tools and techniques			
CLR-3 :	Inculcate the traits needed to be an effective leader and familiarize with the organizational structures and design			
CLR-4 :	Gain valuable insights into strategic process, formulation and implementation			
CLR-5 :	Utilize the intricacies involved in cultural and ethical issues of people			
CLR-6 :	Utilize the dimensions of the planning-organizing-leading-controlling (P-O-L-C) framework			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Observe and evaluate the various influencing factors on the current practice of organization and management	3	80	75	-	H	-	-	-	L	-	H	H	M	-	M	-	-	-
CLO-2 :	Use the techniques and tools of planning and make prudent decisions	2	80	75	-	M	-	-	-	H	-	H	H	M	-	H	-	-	-
CLO-3 :	Identify how organizations adapt to uncertain environment, identify techniques managers use to influence and control the internal environment	2	80	75	-	L	-	-	-	M	-	H	H	H	-	M	-	-	-
CLO-4 :	Apply and execute management goals	2	80	75	-	L	-	-	-	M	-	H	M	H	-	M	-	-	-
CLO-5 :	Manage people and deal with cultural and ethical issues	3	80	75	-	H	-	-	-	H	-	H	H	H	-	H	-	-	-
CLO-6 :	Utilize the basic fundamentals of managing organizations and utilize optimal resources	3	80	75	-	H	-	-	-	M	-	M	M	H	-	M	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Organization	Information technology and the new workplace	Organisational control	Strategic management	People Management
	SLO-2	The Individual and the Organization	Precautious Measures	Control in the Business Setting	Role of Strategy in Management	Importance of people
S-2	SLO-1	Management	Information and decision making	Motivation	Evaluating the Business Environment	Attracting a Quality Workforce
	SLO-2	Primary Functions of Management	Styles of Decision Making	Importance of Employee Motivation	Common Frameworks for Situational Analysis	Recruiting process
S-3	SLO-1	Role of management in organisation	The decision-making process	Leadership	Goals and Process	Employee Diversity
	SLO-2	Advantages of Managing People Well	Barriers to Individual Decision Making	Effective Leader	strategic competitiveness	Conflict Management
S-4	SLO-1	Types of Managers	Planning	Organising	Different Strategies	Organisational Culture
	SLO-2	Role of managers	Planning and Mission	Purpose of Organization	Stages and Types of Strategy	Influences on Organizational Culture
S-5	SLO-1	management Thought	The planning process	organisational design	Strategy formulation	Initiating and Fostering Cultural Change

	SLO-2	*Management Roles*	*The Planning Cycle*	*Common Organizational Structures*	*Bridging the Gaps*	*Putting It Together: Culture and Diversity*
S-6	SLO-1	*Environmental Factors*	*tools, techniques and processes*	*Factors Impacting Organizational Design*	*Strategy implementation*	*Ethics*
	SLO-2	*Internal and External Factors*	*Putting It Together: Planning and Mission*	*Contingencies*	*Overcoming Hindrances*	*Cultural Issues*

Learning Resources	1. *Schermerhorn, J.R., Introduction to Management, 13th ed., Wiley; 2017* 2. *Harold Koontz, Heinz Weihrich, Essentials of management: An International & Leadership Perspective, 10th ed., Tata McGraw -Hill Education, 2015*	3. *Stephen Robbins, Mary Coulter, Fundamentals of Management , 9th ed., Pearson Education, 2016* 4. *Samuel C. Certo, Tervis Certo, Modern management: concepts and skills, 12th ed., Pearson, 2012* 5. *Charles W. L. Hill, Steven Mcshane, Principles of Management McGraw Hill Education, 2017*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
Level 2	Apply Analyze	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
Level 3	Evaluate Create	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Pratap Iyer, Study Abroad Mentors, Mumbai, pratap.iyer30@gmail.com	*1. Dr. A.K. Sheik Manzoor, Anna University, sheikmanzoor@annauniv.edu*	*1. Mr. Mohamed Ibrahim. A. U., SRMIST*
2. Mr. Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	*2. Dr. Devamainthan, University of Madras*	*2. Mr. Muthu Manivannan, SRMIST*

Course Code	18PDH103T	Course Name	SOCIAL ENGINEERING	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	create personal awareness and responsibility
CLR-2 :	learn about environment and approach towards social issues
CLR-3 :	train students on social competencies to become self reliant, resourceful and industrious
CLR-4 :	understand social entrepreneurship
CLR-5 :	develop a mindset to contribute to the society
CLR-6 :	apply knowledge, passion and skills in the pursuit of humanitarian goals

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	identify and addresses needs of social responsibilities	2	80	75	-	-	-	-	-	M	M	H	H	H	-	-	-	-	-
CLO-2 :	resolve social problems	3	80	75	-	-	-	-	-	H	L	M	H	M	-	-	-	-	-
CLO-3 :	understand social responsibility competencies and CSR activities	2	80	75	-	-	-	-	-	M	L	L	H	H	-	-	-	-	-
CLO-4 :	build a business plan to meet social needs	3	80	75	-	-	-	-	-	M	L	H	H	M	-	-	-	-	-
CLO-5 :	gain real time experience through student social responsibility project and presentation	3	80	75	-	-	-	-	-	H	M	H	H	M	-	-	-	-	-
CLO-6 :	possess an in-depth knowledge of social engineering and effect a social change in the society	3	80	75	-	-	-	-	-	H	M	M	M	M	-	-	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Introduction	Environment and society	Social responsibility competencies	Social entrepreneurship	Student Social responsibility
	SLO-2	Importance of Social Engineering	Contribution towards environment	Social responsibility competencies	Social entrepreneurship	Student Social responsibility
S-2	SLO-1	Personal awareness	Social issues	Social responsibility competencies- Profiles	Social Entrepreneur	Project Presentation
	SLO-2	Types of responsibilities	Social issues	Social responsibility competencies- Facets	Types of Social Entrepreneurs	Project Presentation
S-3	SLO-1	Social Change	Group discussion on social Issues	Contributing to community	Success stories of social entrepreneur	Project Presentation
	SLO-2	Social Change	Group discussion on social Issues	Contributing to community	Impact of social entrepreneurs in society	Project Presentation
S-4	SLO-1	Vision towards society	Group discussion on social Issues	Value diversity and Building relationships	Business Plan	Project Presentation
	SLO-2	Mission towards society	Group discussion on social Issues	Value diversity and Building relationships	Business Plan	Project Presentation
S-5	SLO-1	Individual social responsibility(ISR)	Social Marketing	Corporate social responsibility	Business Plan	Report Analysis
	SLO-2	Individual social responsibility(ISR)	Social Marketing	Types of CSR	Business Plan	Report Analysis

S-6	SLO-1	*Case study*	*Non profitable organizations*	*Government Policies on CSR*	*Business Plan*	*Report Analysis*
	SLO-2	*Case study*	*Types of NGO*	*Government Policies on CSR*	*Business Plan*	*Report Analysis*

Learning Resources	**1.** *Joel Makeower, Beyond The Bottom Line: Putting Social Responsibility to work for your Business and the World,Oct,1995* 2. *Simen Sinek, Start with Why, How great leaders Inspire Everyone to Take Action, Penguin UK, 2011* 3. *Adam Grant, Give and Take: Why Helping others drives our success, Orion Publishing Group, 2014* **4.** *David Bornstien, How to change the world, Oxford University Press, 2007*	5. *Nicholls,Alex,ed., Social Entrepreneurship – New Models of Sustainable Social Change, Oxford University Press, 2008* 6. *Ronald R. Sims, Ethics and Corporate Social Responsibility: Why Giants fall, 2003* 7. *Robert A. Rohm, Positive Personality Profiles, Personality Insights, Inc, 2006*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
Level 2	Apply Analyze	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
Level 3	Evaluate Create	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Vijay Nair – Director, Education Matters, vijayn@edmat.org	*1. Dr. A.K. Sheik Manzoor, Anna University, sheikmanzoor@annauniv.edu*	*Mrs. Kavitha Srisaran, SRMIST*
2. Mr. Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	*2. Dr Vanitha. J., Loyola College, vanithaj@loyolacollege.edu*	*Mr. Priyanand P., SRMIST*

Course Code	18PDH201T	Course Name	EMPLOYABILITY SKILLS AND PRACTICES	Course Category	H	*Humanities and Social Sciences including Management*	L	T	P	C
							0	0	2	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*identify problems*			
CLR-2 :	*recognize the logical coherence of ideas*			
CLR-3 :	*understand the structure and principles of writing*			
CLR-4 :	*interpret the structure, organization, tone, and main idea of the content*			
CLR-5 :	*hone comprehension skills*			
CLR-6 :	*give the right knowledge, skill and aptitude to face any competitive examination*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*solve problems*	*3*	*80*	*75*
CLO-2 :	*grasp the approaches and strategies to find solutions*	*2*	*80*	*75*
CLO-3 :	*organize and articulate ideas clearly*	*2*	*80*	*75*
CLO-4 :	*analyze and evaluate contents critically in multifarious ways*	*2*	*80*	*75*
CLO-5 :	*understand, comprehend and provide logical conclusions*	*2*	*80*	*75*
CLO-6 :	*gain appropriate skills to succeed in preliminary selection process for recruitment*	*3*	*80*	*75*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
L	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Arithmetic Divisibility Rules*	*Algebra Quadratic Equation*	*Modern Mathematics - Permutation*	*Geometry II*	*Data Interpretation - II*
	SLO-2	*Arithmetic LCM HCF Factors*	*Problem Solving*	*Modern Mathematics - Combination*	*Problem Solving*	*Problem Solving*
S-2	SLO-1	*Sentence Correction*	*Video Profiling*	*Group Discussion - Introduction*	*Group Discussion – Mock IV*	*Interview Skills – Mock I*
	SLO-2	*Practice*	*Video Profiling*	*Group Discussion – Mock I*	*Group Discussion – Mock IV*	*Interview Skills – Mock I*
S-3	SLO-1	*Arithmetic Unit Digit, Squares*	*Commercial Mathematics - Profit and Loss*	*Modern Mathematics - Probability*	*Mensuration*	*Data Sufficiency- I*
	SLO-2	*Problem Solving*	*Problem Solving*	*Problem Solving*	*Problem Solving*	*Problem Solving*
S-4	SLO-1	*Para Jumbles*	*Critical Reasoning – Type I,II and III*	*Group Discussion – Mock II*	*Resume writing – Tips and Strategies*	*Interview Skills – Mock II*
	SLO-2	*Practice*	*Practice*	*Group Discussion – Mock II*	*Resume Writing - Evaluation*	*Interview Skills – Mock II*
S-5	SLO-1	*Algebra Introduction*	*Commercial Mathematics - Discount and Rebate*	*Geometry I*	*Data Interpretation I*	*Data Sufficiency - II*
	SLO-2	*Algebra Linear Equation*	*Problem Solving*	*Problem Solving*	*Problem Solving*	*Problem Solving*

S-6	SLO-1	*Reading Comprehension*	*Critical Reasoning – Type IV,V and VI*	*Group Discussion – Mock III*	*Interview Skills - Introduction*	*Revision*
	SLO-2	*Practice*	*Practice*	*Group Discussion – Mock III*	*Interview Skills - Introduction*	*Revision*

Learning Resources	*1. Dinesh Khattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations.* *2. Hari Mohan Prasad, Verbal Ability for Competitive Examinations, Tata McGraw Hill Publications* *3. Edgar Thrope, Test of Reasoning for Competitive Examinations, Tata McGraw Hill, 4th Edition, 2012* *4. Norman Lewis, Word Power Made Easy, W.R. Goyal Publications, 2011* *5. Joern Meissner, Manhattan Review, GRE Analytical Writing Guide, Manhattan Review Inc, 2011*	*6. GRE Analytical Writing, Solutions to the Real Essay Topics (Test Prep. Series), Vibrant Publishers, 2011* *7. Wiley's GMAT Reading Comprehension Grail, Wiley, 2016* *8. Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition* *9. Archana Ram, Placementor, Oxford University Press,2018* *10. P.A.Anand, Quantitative Aptitude for Competitive Examinations, Wiley Publication, 2016*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	-	30%	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	-	40%	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	-	30%	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Mr Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	*2. Dr. Devamainthan, University of Madras*	*2. Dr.M.Snehalatha SRMIST*
3. Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com		*3. Mr Jayapragash J SRMIST*
4. Mr.Pratap Iyer, Study Abroad Mentors, Mumbai		*4. Mr.A.Clement SRMIST*

Course Code	18LEH101J	Course Name	ENGLISH	Course Category	H	*Humanities and Social Sciences including Management*	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English and Foreign Languages*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Analyze the importance of communication in personal, professional contexts. Identify proper English pronunciation*
CLR-2 :	*Strengthen vocabulary and grammar. Enhance listening and writing comprehension. Review films and documentaries*
CLR-3 :	*Writing brief paragraphs using appropriate techniques. Enhance their English fluency in speaking*
CLR-4 :	*Write effective essays, stories. Experience workplace communication aspects*
CLR-5 :	*Research on a topic and write a comprehensible academic project reports. Make effective presentations*
CLR-6 :	*Utilize English language skills along with technical skills in build wider career orientations*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify types, modes, channels and barriers of communication. distinguish different speech sounds, pronounce correctly*	*1*	*70*	*60*	*L*	*H*	*L*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-2 :	*Identify, rectify the errors in the use of grammar and vocabulary. Improve listening and writing skills*	*2*	*65*	*60*	*L*	*H*	*L*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*Develop a topic idea into a cohesive paragraph with examples. Improve the fluency of speaking skills*	*3*	*75*	*70*	*L*	*H*	*L*	*H*	*H*	*M*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-4 :	*Develop ideas into logical and coherent essays. Understand better the workplace culture*	*3*	*75*	*65*	*L*	*H*	*L*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*Identify the steps involved in writing an academic project report. List and practice skills need for making a presentation*	*3*	*75*	*65*	*L*	*H*	*L*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-6 :	*Build listening, speaking, reading, writing abilities in English, To interact with English speaking people.*	*3*	*70*	*65*	*L*	*L*	*L*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-

		Communication	Vocabulary and Grammar	Discourse Techniques	Workplace Communication	Project Writing
Duration (hour)		12	12	12	12	12
S-1	SLO-1	*Definition, process of communication*	*Words with Foreign roots, Word formation – inflectional, derivational prefixes, suffixes*	*Sentence structure, Phrases and Clauses*	*Reading Comprehension, Guidelines questions (referential, critical, interpretative)*	*Topics for project writing*
	SLO-2	*Filling in-class worksheets*	*Quiz - Identifying the borrowed roots and their meanings-Worksheet exercise*	*Exercise: worksheet, Identifying phrases, clauses, compound, complex sentences*	*Practice Exercise*	*Discussion*
S-2	SLO-1	*Verbal and non-verbal communication*	*Synonyms and Antonyms and Standard abbreviations*	*Developing ideas into paragraphs – cohesion markers*	*Précis-writing Guidelines*	*Collection of Data – avoiding plagiarism-authenticity and credibility of data*
	SLO-2	*Individual and group activities - Role play*	*Context based activity / Learner compiling standard abbreviations from core subject*	*Identify topic sentence in a paragraph; writing a paragraph based on a topic*	*Practice Exercise*	*Collection of data for verification*
S-3	SLO-1	*LAB: Individual speech sounds*	*LAB: Listening to long conversations*	*LAB: Listening to short stories - Science fiction*	*LAB: Videos on workplace scenario Open Discussion on Workplace Etiquette*	*LAB: Importance of availing credible resources with examples*
	SLO-2	*Courseware on speech sounds (Listening and reproducing)*	*Identify communication contexts, use of making a word list in relation to the context*	*Identify main idea of the given story and narrate a story on the given topic – Written*	*speaking language known to everyone, space, polite words, actions, objective*	*Collecting and compiling resource materials*
S-4	SLO-1	*LAB: often mispronounced sounds*	*LAB: Listening to long conversations, daily life*	*LAB: Speaking - practice activity – brain storming – mind mapping*	*LAB: Videos on workplace communication*	*LAB: Guidelines for preparing a PPT; presentation techniques*
	SLO-2	*Audio visual material (Listening to minimal pairs and reproducing)*	*Identify various communication contexts and answering questions - collocation*	*Just a Minute*	*Role play based on the given workplace contexts*	*Preparing PPT on the topic of learners' choice*

S-5	SLO-1	*Other Types of Communication: general technical-formal, informal-external, interna*	*Homonyms and Homophones*	*Inputs on writing precisely, redundancies, wordiness-repetition-clichés*	*Summarising*	*Guidelines for writing: outline- objectives-background- methodology-discussion*
	SLO-2	*Write upon a selected type of communication*	*Fun activities – worksheets- cross words*	*Error analysis and editing*	*Group activity (oral/written) on the given passages*	*Drafting an outline*
S-6	SLO-1	*Listening, Speaking, Reading, Writing*	*Articles, Tenses*	*Defining, describing technical terms*	*Essay Writing, general introduction*	*Discussion using sample project*
	SLO-2	*Group activity (Newspaper) – Discussion and Feedback*	*Exercise through worksheets- individual activity -peer correction- open discussion*	*Writing definitions-product and process description*	*Brainstorming on relevant technical and non-technical topics*	*Writing the first draft on the selected topic*
S-7	SLO-1	*LAB: Material on mispronounced words*	*LAB: Watching documentaries & short films related to science and technology*	*LAB: Describing a scene or event - videos*	*LAB: Technical communication – Interpreting Data*	*Giving inputs on documentation based on IEEE*
	SLO-2	*Individual oral activity and rectification of the probable mistakes.*	*Picking out the terminology related to science and technology*	*String narration – describing an event or a scene*	*Group activity - interpretation of data - oral presentation*	*Preparing references*
S-8	SLO-1	*LAB: sentence types*	*LAB: Introduction to English es –British and American -Videos*	*LAB: Channels of communication - videos*	*LAB: External Communication-Advertising*	*Checklist for project format (PPT)*
	SLO-2	*Practice on sentence stress and intonation*	*Discussion on difference between British and American words*	*Observing and identifying the channels of communication –Role play*	*ADZAP (promoting a product) - Oral*	*Self-verification and submission of final draft*
S-9	SLO-1	*Communication barriers*	*Noun-pronoun agreement and subject-verb agreement*	*Inputs on Classifying/categorising and sequencing ideas with relevant diagrams*	*Essay Writing Guidelines: introduction, elaboration and conclusion with examples*	*LAB: Formal Presentation*
	SLO-2	*Individual activity- sharing of personal experiences*	*Identifying and learning through error analysis - worksheets*	*Writing a passage on the given hints, tree diagram, classification table and flow chart*	*Individual activity (Written) on the given topic*	*LAB: Formal Presentation*
S-10	SLO-1	*Organizational communication - Channels of communication*	*Misplaced modifiers - prepositions-prepositional verbs and phrasal verbs*	*Importance of punctuation – miscommunication –errors in punctuation*	*Organisational Report Writing - Progress report- Guidelines*	*LAB: Formal Presentation*
	SLO-2	*Group activity (worksheet) with visuals or written material.*	*Learn through practice – placing same modifier in different places in a sentence*	*Fun activities - worksheets for appropriate punctuation - written*	*Writing a progress report*	*LAB: Formal Presentation*
S-11	SLO-1	*LAB: short biographical account on famous personalities -video*	*LAB: Watching video based on daily life*	*LAB: Barriers of communication Language barriers - videos*	*LAB: Sample case studies for work ethics - videos*	*LAB: Formal Presentation*
	SLO-2	*Oral paraphrasing of the content shown*	*Observing and recording the features of spoken English*	*Identifying the language barriers of communication –Written*	*Debate on the videos shown*	*LAB: Formal Presentation*
S-12	SLO-1	*LAB: Listening to short conversations*	*LAB: Watching interviews of famous personalities*	*LAB: Barriers of communication-personal and organizational - video*	*LAB: Learning interview techniques through models*	*LAB: Formal Presentation*
	SLO-2	*Answering the questions on the above content*	*Quiz on the video shown*	*Role play on the videos shown*	*Mock interview*	*LAB: Formal Presentation*

Learning Resources	*1. Swan, Michael. Practical English Usage. OUP, 1995* *2. Kumar Sanjay and Pushpa Lata. Communication Skills. OUP, 2011*	*3. CIEFL, Hyderabad. Exercises in Spoken English. Parts I-III. OUP* *4. Anbazhagan K, Cauveri B, Devika M.P., English for Engineers. Cengage, 2016*	*5. www.mmm.english.com* *6. www.usingenglish.com*	*7. www.onlinewriting.com/purdue* *8. www.ieee.org/index.html*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers				
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts		
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Course Code	18LEH102J	Course Name	CHINESE	Course Category	H	*Humanities and Social Sciences including Management*	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English and Foreign Languages*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Pronounce Chinese Romanization, know about China and Chinese speaking countries, Read basic Chinese characters*			
CLR-2 :	*Help ask about the need, counting numbers, Greet each other, express time and date in daily conversations*			
CLR-3 :	*Ask about directions, learn basic conversation on orientation*			
CLR-4 :	*Daily activities and asking about places and Chinese etiquette*			
CLR-5 :	*List the Chinese festivals and Chinese culture, acquire basic conversational skills*			
CLR-6 :	*Utilize Chinese language skills along with technical skills in build wider career orientations*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Pronounce Chinese language, Identify the basic Chinese scripts, tones and greetings*	*1*	*60*	*60*	-	-	*M*	-	*M*	*H*	*L*	*M*	*H*	*L*	-	*H*	-	-	-
CLO-2 :	*Identify basic grammar, count numbers, tell date and time, make interrogative sentences and basic conversations*	*2*	*65*	*62*	-	-	*H*	-	*H*	*M*	*L*	*M*	*H*	*M*	-	*H*	-	-	-
CLO-3 :	*Ask different kinds of questions, to tell age using Chinese words*	*2*	*68*	*63*	-	-	*M*	-	*M*	*L*	*L*	*M*	*L*	*M*	-	*H*	-	-	-
CLO-4 :	*Identify the different usage of Chinese grammar and vocabulary and introduce one self*	*2*	*69*	*65*	-	-	*H*	-	*H*	*H*	*L*	*M*	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*Appropriately use different verbs and adjectives in basic conversations*	*2*	*72*	*63*	-	-	*H*	-	*H*	*H*	*L*	*M*	*M*	*H*	-	*H*	-	-	-
CLO-6 :	*Build listening, speaking, reading, writing abilities in Chinese, To interact with Chinese people and understand their culture*	*2*	*70*	*60*	-	-	*H*	-	*H*	*H*	*L*	*M*	*H*	*H*	-	*H*	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*About china, Chinese speaking country, chinese language & culture.*	*Numbers in Chinese.*	*Introduction of few basic W/H words and framing basic interrogative sentences*	*Making of Affirmative negative question in Chinese*	*Introduction & application of few frequently used construction in Chinese.*
	SLO-2	*Introduction of initials, finals in Mandarin*	*Counting numbers and numeric system*	*Nationality*	*Conversation to make suggestion, accept of dealing suggestion, make comments.*	*Introduction & application of few frequently used construction in Chinese.*
S-2	SLO-1	*Tables of combination of initials and finals in Putonghua(Mandarin)*	*Chinese monetary system, Counting Chinese currency.*	*Direction in Chinese.*	*Sentence with nominal predicate, Subject verb construction as its predicate.*	*Famous Chinese festivals*
	SLO-2	*Basic greetings, Phrases used in daily life (in pinyin)*	*Converse to greet others, express needs*	*Making question with 几,多少*	*Fruit related vocabulary, application.*	*Major Chinese cities*
S-3	SLO-1	*Tables of combination of initials and finals in Putonghua(Mandarin)*	*Asking your need*	*Introducing one's nationality*	*Asking question with ma , wh words, affermative -negative*	*Application and usage of construction*
	SLO-2	*Tables of combination of initials and finals in Putonghua(Mandarin)*	*Nominal measure word*	*Asking about nationality*	*Lianxi*	*Lianxi*
S-4	SLO-1	*Prononciation of Pinyin chart*	*Telling phone number in chinese*	*Asking price*	*Asking question with ma , wh words, affermative -negative*	*Application and usage of construction*
	SLO-2	*Prononciation of Pinyin chart*	*Converting numbers*	*Lianxi*	*Lianxi*	*Lianxi*
S-5	SLO-1	*Introduction of Four Tones in Chinese language.*	*Time & time related greetings,*	*Politely and formally asking names ,Expressing apology.*	*Making Chinese sentences with verbal & Adjectival predicate.*	*Grammar related to 但是，可是，以前，以后，后来。*
	SLO-2	*Four Tones and related pronunciation.*	*Days&Seasons.*	*Introduction & Application of verbal Measure Word.*	*Introduction of 地*	*Introduction & Application of the basic optative verbs like会，能，可以.*

S-6	SLO-1	*Tonesandhi（一， 不）in Chinese Tone discrimination in Chinese*	*Sentence patterns in Chinese, S-V-O sentences. Framing simple sentences.*	*Make sentences with在,and few corelated words like 这儿， 那儿 with example*	*Few basic verbs and adjectives.*	*conversation how todescribe likes ,dislikes, interest and hobbies*
	SLO-2	*Chinese characters. The eight strokes of characters, proper stoke orders.*	*Introduce 是 and 不是*	*Important locations used in daily life.*	*Opposite words.*	*Conduct conversation how todescribe likes, dislikes.,interest and hobbies*
S-7	SLO-1	*Pronounce word in proper tone*	*Vocabulary*	*Asking about places.*	*Usage of verbs*	*Usage of grammar*
	SLO-2	*Personal Pronouns and relations, Plural forms of pronouns*	*Asking date and time*	*lianxi*	*练习*	*lianxi*
S-8	SLO-1	*Writing characters with proper stroke order*	*Usage of time words in a sentence*	*Asking about directions.*	*Usage of adjectives with different adverbs*	*Asking about interest and hobbies*
	SLO-2	*Writing characters with proper stroke order*	*Introducing each other*	*lianxi*	*练习*	*lianxi*
S-9	SLO-1	*Sentence structure with the adjective 很 and Framing sentences, negative of 很。*	*Weekdays in Chinese, Month, Year&Writing Date.*	*Profession relatedvocabulary, application withexamples.*	*Colour and vocabulary, application withexamples.*	*Conversation how to bergain and purchase products.*
	SLO-2	*Introduction of adverb 也， Interrogative particle呢， application & Usages.*	*Introduction of verb有 and it'snegative form .Nominal measure word.*	*Basic conversation about persons ouccupation*	*describe family members and talk about university and department*	*conversation how to bergain and purchase products.*
S-10	SLO-1	*Possesive/ Structural Particle的, application of 的with pronouns.*	*Framing of basic interrogative sentences with modal particle吗。*	*Introduction of interrogative phrase 多大， Tellingone'sage in Chinese.*	*Sports &Games realated vocabulary, special usages,*	*Use of conjugation 还是， 或者with example.*
	SLO-2	*Writing Chinese characters basic conversation related to greetings*	*Framing of basic interrogative sentences with modal particle吗。*	*Introduction of past tense and aspect particle 了。*	*application withexamples.*	
S-11	SLO-1	*Writing greetings in characters with proper stoke order*	*Asking simple question*	*Asking age*	*Asking about likes and dislikes*	*Asking about purchasing products*
	SLO-2	*练习*	*Asking date*	*lianxi*	*Asking about likes and dislikes*	*Asking about purchasing products*
S-12	SLO-1	*Basic Expression*	*Birthday in Chinese*	*Asking about occupation*	*Asking about family members*	*Usage of conjugation*
	SLO-2	*练习*	*Grammar – has, have*	*lianxi*	*Asking about family members*	*Usage of conjugation*

Learning Resources	*1. Liu Xun, New Practical Chinese reader, Beijing Language and Culture University Press, 2008*	*2. Elementary Chinese Reader- 1, Sinolingua Beijing China, 2007*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	18LEH103J	Course Name	FRENCH	Course Category	H	*Humanities and Social Sciences including Management*	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English and Foreign Languages*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Get to know about France, its culture, heritage and countries speaking French. Build basic abilities to converse in French*			
CLR-2 :	*Identify and ask for information. Describe people with adjectives. Build conversational abilities*			
CLR-3 :	*Ask for and Provide directions, Identify French educational system, Draft a curriculum vitae*			
CLR-4 :	*Tell Time and converse in time related situations, Identify French etiquette*			
CLR-5 :	*Appreciate French cuisine and their food habits*			
CLR-6 :	*Utilize French language skills along with technical skills in build wider career orientations*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify and pronounce French alphabets, Greet, Converse, Introduce, Read, identify basic French grammar*	*1*	*70*	*60*	-	-	*M*	-	*M*	*H*	*L*	*M*	*H*	*H*	-	*H*	-	-	-
CLO-2 :	*Identify French adjectives, verbs ending in"er" and frame simple sentences and make conversations*	*2*	*65*	*60*	-	-	*H*	-	*H*	*M*	*L*	*M*	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*Orient someone by giving directions, Ask for directions, Express possession, conjugate verbs in "ir', Draft curriculum vitae*	*2*	*65*	*60*	-	-	*L*	-	*M*	*L*	*L*	*M*	*L*	*L*	-	*H*	-	-	-
CLO-4 :	*Express and use time, create a routine using reflexive verbs, conjugate a reflexive verb and regular verbs in "re"*	*3*	*75*	*65*	-	-	*H*	-	*H*	*H*	*L*	*M*	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*Paragraph on French food habits and also their own using partitive articles. Alimentation is associated with partitive articles*	*3*	*75*	*65*	-	-	*H*	-	*H*	*H*	*L*	*M*	*M*	*H*	-	*H*	-	-	-
CLO-6 :	*Build listening, speaking, reading, writing abilities in French, To interact with French people and understand French culture*	*3*	*70*	*65*	-	-	*H*	-	*H*	*H*	*L*	*M*	*H*	*H*	-	*H*	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*L'alphabet, Les accents*	*Les nombres 70 à 100*	*Les articles contractes (au...)*	*Les adjectifs démonstratifs*	*La forme négative (ne…plus, ne…. Jamais*
	SLO-2	*Les salutations*	*Les nombres 101 a 1000*	*Les articles contractes (du..)*	*La famille*	*La forme négative (ne…que. Ne… rien)*
S-2	SLO-1	*Les pronoms sujets, Les verbes: être, avoir, s'appeler, habiter*	*Le genre des noms*	*Les verbes : Vouloir, pouvoir, devoir*	*Les 2 groupes verbes*	*Les verbes acheter, manger, Commencer, payer*
	SLO-2	*Les articles indéfinis*	*le nombre des noms*	*Les verbes irréguliers*	*Les verbes : sortir, partir*	*L'argent*
S-3	SLO-1	*L'expression*	*Comprendre une petite annonce*	*Faire une enquête*	*Proposer a qqn pour une sortie*	*Demander le prix*
	SLO-2	*Les salutations*	*Rédiger une annonce simple*	*Ecrire une liste*	*Proposer a qqn de faire qqc*	*Faire les courses*
S-4	SLO-1	*Se communiquer en classe*	*Chercher un logement*	*Les gouts des autres*	*Apprécier qqc*	*Les services et les commerces*
	SLO-2	*Epeler, s'appeler*	*Décrire un logement*	*Les temps libres et les loisirs*	*Ne pas apprécier qqc*	*Payer ses achats*
S-5	SLO-1	*Les numéros 0 a 69*	*Le 1 e groupe verbe, les professions*	*Les adjectifs interrogatifs*	*Le 3e groupe verbes*	*L'impératif affirmatif*
	SLO-2	*Les jours, les mois, les émotions*	*Les verbes venir et aller*	*Les mots interrogatifs*	*Les vêtements*	*L'impératif négatif*
S-6	SLO-1	*Les pays, les couleurs*	*Le genre des adjectifs*	*Les verbes pronominaux(1)*	*Les adverbes de fréquence*	*Les articles partitifs*
	SLO-2	*Des portraits de pays francophones*	*les nombre des adjectifs*	*Les verbes pronominaux(1)*	*Les adverbes de temps*	*Les exp. De quantités*
S-7	SLO-1	*Présentez- vous*	*Les vocabulaires des objets*	*Parler de ses loisirs*	*Décrire une tenue*	*Accepter une invitation*
	SLO-2	*Présenter qqn*	*Décrire son voisin*	*Exprimer ses gouts*	*Décrire les accessoires*	*refuser une invitation*
S-8	SLO-1	*S'informer sur qqn*	*Décrire votre profession*	*Exprimer une préférence*	*Parler qqc*	*Donner son appréciation*
	SLO-2	*Demander des informations personnelles*	*La langue, activité recap.*	*Exprimer une envie, Activité quotidienne*	*justifier*	*S'exprimer a table*
S-9	SLO-1	*Les prépositions de lieu (1)*	*Les adjectifs possessifs (sing)*	*Le verbe aller*	*Le passe compose : avoir*	*Le pronom « en » de quantité*
	SLO-2	*Les verbes : parler, habiter*	*Les adjectifs possessifs (pl)*	*Le futur proche*	*Le passe compose : etre*	*Il faut*

S-10	SLO-1	*Les articles définis*	*Les prépositions de lieu(2)*	*L'heure*	*L\imparfait (1)*	*Les festivals du mot*
	SLO-2	*Les pronoms Personnelles*	*Les orientations*	*Les Temps*	*L'imparfait (2)*	*Les festivals en France*
S-11	SLO-1	*Demander poliment*	*Les pièces, l'équipement*	*Demander l'heure*	*Parler d'un film*	*Donner des instructions (il Faut)*
	SLO-2	*Répondre poliment*	*S'infirmer un logement*	*Dire l'heure*	*Féliciter un souhait*	*Cuisine d'une parisienne d'adoption*
S-12	SLO-1	*Les vocabulaires d'informatique*	*Ecrire un portrait*	*Raconter sa vie sur un blog*	*Adresser un souhait*	*Commander au restaurant*
	SLO-2	*S'inscrire sur un site*	*La description physique*	*Justifier*	*Ecrire une carte postale*	*Ecrire une recette*

Learning Resources	1. *SAISONS 1 – Didier - 2017*	2. *BIENVENUE – Course Book in French – Department of EFL, SRMIST- 2017*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember / Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply / Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate / Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
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Course Code	18LEH104J	Course Name	GERMAN	Course Category	H	*Humanities and Social Sciences including Management*	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English and Foreign Languages*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Get to know about Germany, its culture, heritage. Build basic abilities to converse in German*
CLR-2 :	*Identify and ask for information. Introduce oneself. Build conversational abilities*
CLR-3 :	*Ask for and Provide directions in German, Identify German cities, buildings and everyday life like cuisine*
CLR-4 :	*Develop the ability to read, understand and initiate a conversation*
CLR-5 :	*Enable basic conversational skills to behave in a German speaking society, in restaurants and in public places*
CLR-6 :	*Utilize German language skills along with technical skills in build wider career orientations*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify and pronounce German alphabets, Greet, Converse, Introduce, Read, identify basic German grammar*	*1*	*70*	*60*	-	-	*L*	*L*	*M*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-2 :	*Compose dialogue between strangers, ask simple information*	*2*	*65*	*55*	-	-	*M*	*L*	*M*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*Orient someone by giving directions, by using Imperatives and different types of definite & indefinite articles*	*2*	*73*	*60*	-	-	*M*	*M*	*H*	*M*	*M*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-4 :	*Write a dialogue by using different verbs of Accusative articles*	*3*	*65*	*55*	-	-	*M*	*M*	*H*	*H*	*M*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*Create conversations in social places like; restaurants, identify and order food varieties*	*3*	*65*	*55*	-	-	*M*	*M*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-6 :	*Build listening, speaking, reading, writing abilities in German, linteract with Germans and understand their culture*	*3*	*75*	*65*	-	-	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*Alphabets, Grüßen und Verabschieden.*	*UmbestimmtArtikel im Nominativ.*	*T, N, D verbenkonjugationen und Satzschreiben.*	*Die Uhezeiten verstehen und nennen.*	*Etwasgemeinsam planen, über Geburtstag sprechen.*
	SLO-2	*Über Länder, Sprachensprechenim Deutschland, WichtigeStädteim Deutschland.*	*Zahlenbis 1000 und Wortschatz.*	*Ordinal Zahlen und Tagezeiten*	*Zeitangabenmachen.*	*Schreiben Sie: Einladung für ihre Geburtstag.*
S-2	SLO-1	*Zahelenbis 20, Sich und andere Vorstellen.*	*Plätze und Gebäudebe nennen, Fragenzuortenstellen.*	*ÜberessensprechenVerschiedeneGerichte in Deutschland durch PPT.*	*Umregelmäßige verbenkonjugationen und BeispieleSatz.*	*Possessive Artikel im Akkuativ.*
	SLO-2	*Telefonnummer und E-mail Adressenennen.*	*Negation und übersetzung.*	*Buchstabieren und Wortschtz.*	*"ieren" verben conjugation und Beispielesatz.*	*BeispieleSätze.*
S-3	SLO-1	*Alphabet Aussprache und hört die grüßen.*	*Hörübung: Die Telefonnummer.*	*Hörübung: Aussprache die Umlauteä, ö, ü und beispieleSätze.*	*Hörübung: Dem Dialog zuhören und die Zeit schreiben.*	*E-mail schreiben: Einladung ihrer Geburtstagsferier.*
	SLO-2	*Verabschiedenen Wörten.*	*Buchstabieren und Wortschtz.*	*Hören und buchstabieren.*	*Übungen.*	*Übungen.*
S-4	SLO-1	*Länder, Sprachen, Der Film: Über den Guten Tag und die Telefonnummer.*	*Der Film: Über die Sehenwürdigkeiten in Detschland.*	*Dialog: Über das Essen und seine preisepraktizieren.*	*Mit den Reguläßige und Umregelmäßigen verbeneigene Sätze schreiben*	*Das Gesprächhören und verstehen.*
	SLO-2	*Übungen.*	*Sprechen über den wichtige Städte im Deutschland.*	*Übungen.*	*"ieren" verben konjugationen.*	*Wortschatz und buchstabieren.*
S-5	SLO-1	*Über Länder und Sprachensprechen.*	*Himmelsrichtungen und Verkehrsmittel nennen.*	*Einen Einkauf Planen und sprechen*	*Über die Familiesprechen und sichverabreden.*	*Das Briefeschreiben erklären, eineEinldung verstehen und schreiben.*
	SLO-2	*Hören und buchstabieren.*	*NachdemWegfragen und einem Wegbeschreiben*	*Gespräche beim Einkauf führen.*	*Sich für eine verspätung entschuldigen.*	*Personal pronomen und beispieleSätze.*

S-6	SLO-1	*Aussagesatz und personal pronomen in Nominativ und beispieleSätze.*	*Texte mit internationalenwörtern verstehen.*	*Gesprächebeim Essen führen.*	*EinenTermin telefonisch vereinbaren.*	*ImRestaurentbestellen und bezahlen, übereinEreignis sprechen,*
	SLO-2	*ÜberArbeit, Berufe und Arbeitszeitensprechen.*	*Artikel lernen.*	*W-fragen texte verstehen.*	*Schreiben Sie die Uhrzeiten.*	*BestimmtInformationen in Texten finden.*
S-7	SLO-1	*Übersich und anderesprechen.*	*Hörübung: Schreiben Sie die Zahlen.*	*Kurzer Dialog über das Einkaufen.*	*Üben: Wie man den Termin festlegt.*	*Schreiben eines Briefes über jede gegebene situation.*
	SLO-2	*Fragen und antworten.*	*Events im Hamburg.*	*Übungen: Verben konjugationen.*	*Hören und buchstabieren.*	*Übungen: Trennbare Verben konjugationen.*
S-8	SLO-1	*Sich und anderevorstellen.*	*Fragen Sie die Wegbeschreibung in dem sie die Bildersehen.*	*Kurzer Dialog über das Essen.*	*Hörübung: Die Zeit durch hören des Dialogs schreiben.*	*Hörübung und Schreiben: Freizeitaktivitäten.*
	SLO-2	*W-Fragen.*	*Lesen und verstehen.*	*Hören: wie man bestellt.*	*Übungen.*	*Satzmithilfsverben.*
S-9	SLO-1	*Zahlen ab 20 nennen, über Jahrezeiten im Deutschland.*	*Imperativ mit Sie, Lesen und verstehen.*	*Wortschatz und Buchstabieren.*	*Umbestimmt Artikel im Akkusativ.*	*Untrennbare verben konjugationen. Beispiele Sätze.*
	SLO-2	*Wochentage und Monate.*	*Lange und KurzeVokale.*	*Schreiben Sie die Sätze.*	*Zeitangabenmit am, um, von…. bis.*	*BeispieleSätze.*
S-10	SLO-1	*Bestimmt Artikel in Nominativ.*	*Regelmäßige verben Konjugationen.*	*PositionenimSatz, Bestimmt Artikel im Akkusativ.*	*Erklärt die Grammatik Präpositionen im Akkusativ.*	*Präteritum von Hilfsverben und konjugationen.*
	SLO-2	*Verwendungen von Hilfsverben.*	*Satzschreiben.*	*AkkusativVerben konjugationen.*	*BeispieleSätze im Präpositionen .*	*Modal verben konjugationen und beispiele Sätze.*
S-11	SLO-1	*Ja oder NeinFragen durch PPT.*	*Der Imperetivsätze und auch die Regelmäßigeverben*	*Essen im D-A-CH, Beruferund ums Essen.*	*Hören und sprechen: die Tagesablauf.*	*Übung für Modal verben wie, Aussagesatz, Satzfrage.*
	SLO-2	*Typische Hobby's.*	*Lernen Sie die Sätze durch PPT.*	*Hören Sie den dialog.*	*Schreiben: Die Tagesabluf.*	*W-Frage und Trennabreverben.*
S-12	SLO-1	*Der Film: Über den Termin.*	*Der Film: Die Autofahrt und das Verkehrsmittel.*	*Der Film: Frühstück bei den Bergs.*	*Pünktlichkeit in D-A-CH und Der Film: Nie hast du Zeit und Termine.*	*Der Film: Hast du Zeit? Im Restaurant und Überraschung.*
	SLO-2	*Über deineFamilie.*	*Claudia Berg in der Arbeit.*	*Einkaufen planen.*	*Der Termin und die Verabredung.*	*Schreiben Sie die Sätze mit Hilfs verben.*

Learning Resources	*1. Netzwerk – Klett – Langeiseheidt, Munchen, 2015*	*2. Grundkurs Deutsch, Dept.of EFL, SRMIST*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
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Course Code	18LEH105J	Course Name	JAPANESE	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							2	0	2	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English and Foreign Languages	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Identify the basics of Japan language and the facts of Japan, Make useful expressions and basic conversations.			
CLR-2 :	Identify someone and ask for information. Physical description of people with adjectives. Focus of basic conversation			
CLR-3 :	Ask and give directions, Use conversation on orientation. Identify the Japan educational system			
CLR-4 :	Create daily activities and tell time. Appreciate Japan etiquette. Conjugate a reflexive verb and 3rd group of regular verbs			
CLR-5 :	Identify diverse food habits of the Japanese people.			
CLR-6 :	Utilize Japan language skills along with technical skills in build wider career orientations			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Identify, pronounce Japan alphabets, know about Japan, its culture. Greet each other and converse, Introduce oneself	1	70	60	M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-2 :	Describe with the help of Japan adjectives, identify first group verbs ending in e. Frame simple sentences	2	65	65	M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-3 :	Orient someone by giving directions, Express possession and conjugate 2nd group verbs. Draft their own curriculum vitae	2	65	65	M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-4 :	Express time and use expressions of time in daily conversations, paragraph on daily routine with the help of reflexive verbs	3	75	65	M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-5 :	Create a paragraph on the food habits of the Japan people and also their own using particles.	3	75	65	M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-6 :	Build listening, speaking, reading, writing abilities in Japan, To interact with Japan people and understand Japan culture	3	75	65	M	L	L	L	M	H	M	H	H	M	L	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Introduction to Japan	Hiragana Lesson 7 Ma and Ya series.	Lesson 5 – Particles.	Lesson 6 – renshuu and exercises	Lesson 9 Renshuu
	SLO-2	Japanese language and culture	ma/ya series related words	Japanese sports.	Religious beliefs,.	Explanation of ~te form I Group
S-2	SLO-1	Greetings	Lesson 3 – time - reading	Japanese martial arts.	Lesson 7 – reading and grammar	Explanation of ~te form II Group
	SLO-2	Self Introduction	Lesson 3 grammar.Classroom expressions. Kara, made, ni, ne and o	De and to	Ongaku and manga	Explanation of ~te form II and III Group
S-3	SLO-1	Hiragana Lesson 1 (vowels and related words)	Hiragana Lesson 8 Ra/Wa series	Kanji	Common expressions	Exceptional cases of verb groups
	SLO-2	Lesson 1– reading. Self introduction	Ra/Wa series related words	iku, miru, yasumu and kau	Body parts (vocabulary).	Line
S-4	SLO-1	Lesson 1 grammar (wa,ka,mo,no,desu/ja arimasen)	Lesson 3 – renshuu and exercises	Revision of complete Hiragana	Explanation of past tense of verbs.	Lesson 10 - reading and grammar
	SLO-2	Days of the week	Family. Festivals of Japan.Omiyage	Revision of all Particles	Kanji – kuchi, ame, hairimasu, kirimasu, ji, han and fun	Explanation of ~tai form
S-5	SLO-1	Hiragana Lesson 2	Hiragana Lesson 9	Assignment	Lesson 7 reading.	Japanese currency.
	SLO-2	ka and ga series and related words	Double consonants and related words	Assignment	Lesson 7 exercises	Japanese political system
S-6	SLO-1	Lesson 1 – renshuu	Lesson 4 – reading, grammar and vocabulary	Surprise Test	Introduction to Adjectives	Lesson 10 – renshuu and exercises.
	SLO-2	Ojigi and exercises. Numbers and months	Directions. Kanji – person, man, woman, child, tree and book	Surprise Test	I-ending and na-ending adjectives Forms.	Kanji – ookii, chiisai, eki and chuui

S-7	SLO-1	*Hiragana Lesson 3*	*Directions. Kono…, kochira…, yo.*	*Revision of Hiragana (3 charts),*	*Lesson 8 Reading*	*Kanji – daigaku, nen, nihon and nihongo*
	SLO-2	*sa and za series and related words*	*I & na-ending adjectives introduction*	*long vowels and double consonants*	*Lesson 8 grammar*	*Places of interest in Japan*
S-8	SLO-1	*Seasons.*	*Hiragana Lesson 10 (long vowels and related words).*	*Review of grammar*	*Explanation of ~masen ka*	*Food and drink (vocabulary).*
	SLO-2	*Kore/kono – demonstrative pronouns*	*Lesson 4 – renshuu*	*Particles*	*Explanation of mashou*	*Transport*
S-9	SLO-1	*Hiragana Lessons 4 and 5*	*Hashi*	*Katakana – introduction*	*Lesson 8 – renshuu.*	*Review of particles*
	SLO-2	*ta/da and na/ha series and related words*	*Hiragana Lesson 11 (chart 3 and related words).*	*Katakana – rules*	*Value your time*	*Review of Kana and Kanji*
S-10	SLO-1	*Kore…/kono…-reading, grammar and vocabulary*	*Counters explanation*	*Review of lessons 1-5*	*Kanji - days of the week*	*Review of verbs and adjectives*
	SLO-2	*Ni and ga, arimasu/imasu, Dare/donata.Renshuu and Meishi*	*Kanji – days of the week*	*Grammar and vocabulary*	*Japanese food and*	*Japanese house and living style*
S-11	SLO-1	*Hiragana Lesson 6 (ba/pa series).*	*Hiragana – special words like wa, e and o and sentence reading*	*Katakana vocabulary*	*Lesson 9 reading*	*Japanese tea ceremony*
	SLO-2	*Lesson 2 – exercises. Introduction to time.*	*Lesson 5 – reading.*	*Kanji – ikimasu, mimasu, yasumimasu*	*Lesson 9 grammar*	*Japanese Religious beliefs.*
S-12	SLO-1	*Kanji numbers – 13. Time expressions*	*Lesson 5 Grammar.*	*Lesson 6 – reading and grammar*	*Stationery*	*Japanese Economy*
	SLO-2	*Colours and basic 5 kanjis (ue, shita, naka, yama and kawa)*	*Lesson 5 Vocabulary.*	*Visiting a Japanese home*	*Transport (vocabulary)*	*Calligraphy*

Learning Resources	*1. Minna no Nihon Go, 3A Corporation, Tokyo, Japan, 2002*	*2. A Basic Course in Japanese – Department of EFL, SRMIST, 2017*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Usha Kodandaraman, ABK AOTS, Chennai. drushak@gmail.com	*1. Dr. S. P. Dhanavel, IIT Madras, dhanavelsp@iitm.ac.in*	*1. Ms.R.Padmajaa, SRMIST*
2. Mr. Paul Das, NEC, Chennai	*2. Dr. K. Anbazhagan, SRMIST*	*2. Mr. B.Vijaya Kumar, SRMIST*

Course Code	18LEH106J	Course Name	KOREAN	Course Category	H	*Humanities and Social Sciences including Management*	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English and Foreign Languages*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Know about Korea and its culture; to be able to read, write the Korean script, and to introduce oneself and other people*
CLR-2 :	*Manage daily life living in Korea. Talking daily activities. Asking for and giving directions, describing the location*
CLR-3 :	*Be able to shop by asking for the availability of things, and learning about the currency system*
CLR-4 :	*Tell time, to socialize: make appointments, talk about weekend plans/activities*
CLR-5 :	*Communicate about studying Korean and about future career or academic plans*
CLR-6 :	*Utilize Korean language skills along with technical skills in build wider career orientations*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Read, pronounce and write the Korean script, Introduce oneself and other people. Get to know about Korea and its culture*	*1*	*70*	*60*	-	-	*L*	-	*H*	*H*	*L*	*M*	*M*	*H*	-	*H*	-	-	-
CLO-2 :	*Manage daily life in Korea - ask for and give directions, describe locations, count, shop, and talk about daily activities*	*2*	*65*	*65*	-	-	*L*	-	*H*	*M*	*L*	*M*	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*Talk about past activities (past tense), the weather and use the Korean currency*	*2*	*65*	*65*	-	-	*L*	-	*M*	*H*	*L*	*M*	*M*	*M*	-	*H*	-	-	-
CLO-4 :	*Tell time, to socialize: make appointments, talk about weekend plans/activities*	*3*	*75*	*65*	-	-	*L*	-	*H*	*H*	*L*	*M*	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*Communicate about studying Korean and about future career or academic plans*	*3*	*75*	*65*	-	-	*L*	-	*H*	*M*	*L*	*M*	*H*	*H*	-	*H*	-	-	-
CLO-6 :	*Build listening, speaking, reading, writing abilities in Korean, To interact with Korean people and understand Korean culture*	*3*	*75*	*65*	-	-	*L*	-	*H*	*H*	*L*	*M*	*H*	*H*	-	*H*	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*Introduction to Korea and Korean - 한글소개, 한국 소개*	*2. 일상 생활daily life, new vocab (action, places)*	*listening &key sentences drilling*	*dialogue1& dialogue2 practice*	*grammar point 1-그래서*
	SLO-2			*reading/writing*		*grammar point1-(으)ㄹ거예요*
S-2	SLO-1	*single vowels (단모음)*	*grammar point1-아요/ 어요&grammar point2-에 가다*	*5.쇼핑2 shopping2 new vocab (counter noun)*	*listening &key sentences drilling*	*dialogue1& dialogue2 practice*
	SLO-2				*reading/writing*	
S-3	SLO-1	*이중모음과 자음 double vowels & basic consonants*	*dialogue1& dialogue2 practice*	*grammar point1-ㅂ니다/습니다,-ㅂ니까/습니까&*	*8.시간time new vocab (time)*	*listening & reading*
	SLO-2					
S-4	SLO-1	*쌍 자음과 음절double consonants & syllables*	*listening & reading/writing*	*teaching money*	*Teaching date & weeks*	*writing for weekend activities*
	SLO-2					
S-5	SLO-1	*받침과 음절1 Batchim & syllables*	*3.위치location new vocab(object /location)*	*dialogue1& dialogue2 practice*	*grammar point1-에*	*11.한국어 공부(studying Korean) new vocab(pronouns)*
	SLO-2				*grammar point2-시-분*	
S-6	SLO-1	*받침과 음절2 Batchim & syllables*	*grammar point1-이/가*	*listening &key sentences drilling*	*dialogue1& dialogue2 practice*	*grammar point1- 나/저, 내/제*
	SLO-2		*grammar point2-에 있다/없다*	*reading/writing*		*grammar point2-'ㄷ' irregular verbs*
S-7	SLO-1	*자모 연습 (practices vowels and*	*dialogue1& dialogue2 practice*	*6.어제 일과yesterday's daily routine new*	*listening &key sentences drilling*	*dialogue1& dialogue2 practice*

	SLO-2	*consonants)*		*vocab (action, places)*	*reading/writing*	
S-8	SLO-1	*듣기. 교실 표현(listening & class terms)*	*listening &key sentences drilling*	*grammar point1-았/었*	*9. 약속 appointment new vocab(location& plan*	*listening &key sentences drilling*
	SLO-2		*reading/writing*	*grammar point2-에서*		*reading/writing*
S-9	SLO-1	*1.자기/소개self –introduction , new vocab(nationality, occupation*	*4. 쇼핑1shopping1 new vocab (items to shop)*	*dialogue1& dialogue2 practice*	*grammar point1- (으)ㄹ까요*	*12.계획(plan) –(으)ㄹ 거예요.*
	SLO-2				*grammar point2- 아요/어요*	
S-10	SLO-1	*grammar point1- 이/에요/예요*	*shopping1 teaching numbers*	*listening &key sentences drilling*	*dialogue1& dialogue2 practice*	*grammar point1- pro nouns 이/그/저 + 것(things)*
	SLO-2	*grammar point2-은/는*		*reading/writing*		*grammar point2- '—' irregular verbs & dialogue2*
S-11	SLO-1	*dialogue1& dialogue2 practice*	*grammar point1-을/를*	*7. 날씨/ weather new vocab(season& weather)*	*listening &key sentences drilling*	*dialogue1& dialogue2 practice*
	SLO-2		*grammar point2-(으)세요*		*reading/writing*	
S-12	SLO-1	*listening &key sentences drilling*	*dialogue1& dialogue2 practice*	*grammar point1-그리고*	*10.주말 활동 (weekend activities) new vocab (places& weekend activities)*	*listening &key sentences drilling*
	SLO-2	*reading/writing*		*grammar point2-안*		*reading/writing*

Learning Resources	*1. Sejong Korean 1, The National Institute of the Korean Language. Hawoo Publisher, 2013*	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Usha Kodandaraman, ABK AOTS, Chennai. drushak@gmail.com	*1. Dr. S. P. Dhanavel, IIT Madras, dhanavelsp@iitm.ac.in*	*1. Jang kyung A, SRMIST*
2. Mr. Paul Das, NEC, Chennai	*2. Ms. Subashree, VIT, Chennai, subashree@vit.ac.in*	*2. Ms. Cho Seul Hee, SRMIST*

Course Code	18PDH101T	Course Name	GENERAL APTITUDE	Course Category	H	*Humanities and Social Sciences including Management*	L	T	P	C
							0	0	2	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Recapitulate fundamental mathematical concepts and skills*
CLR-2 :	*Hone critical thinking skills by analyzing the arguments with explicit and implicit premises*
CLR-3 :	*Sharpen logical reasoning through skillful conceptualization,*
CLR-4 :	*identification of relationships between words based on their function, usage and characteristics*
CLR-5 :	*nurture passion for enriching vocabulary*
CLR-6 :	*Acquire the right knowledge, skill and aptitude to face any competitive examination*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Build a strong base in the fundamental mathematical concepts*	*2*	*80*	*75*	*L*	*H*	-	*H*	*M*	-	-	-	*H*	*H*	*L*	*H*	-	-	-
CLO-2 :	*Identify the approaches and strategies to solve problems with speed and accuracy*	*2*	*75*	*70*	-	*H*	-	*H*	*M*	-	-	-	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*Gain appropriate skills to succeed in preliminary selection process for recruitment*	*2*	*80*	*75*	-	*H*	-	*H*	*M*	-	-	-	*H*	*H*	*L*	*H*	-	-	-
CLO-4 :	*Collectively solve problems in teams and groups*	*3*	*75*	*70*	*L*	*H*	-	*H*	*M*	-	-	-	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*Build vocabulary through methodical approaches*	*3*	*85*	*80*	-	*H*	-	*H*	*M*	-	-	-	*H*	*H*	*L*	*H*	-	-	-
CLO-6 :	*Enhance lexical skills through systematic application of concepts and careful analysis of style, syntax, semantics and logic*	*2*	*85*	*80*	-	*H*	-	*H*	*M*	-	-	-	*H*	*H*	-	*H*	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Types of numbers, Divisibility tests*	*Square root, Cube roots, Remainder*	*Percentage Introduction*	*Discount*	*Logarithms Intro*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S-2	SLO-1	*Introduction to Significance of Verbal Aptitude in Competitive Examinations*	*Contextual Vocabulary Exercise – Synonyms*	*Sentence Completion Basic Level Exercises – Single Blank*	*Reading Comprehension – Introduction*	*Grammar Rules – A comprehensive Introduction*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S-3	SLO-1	*LCM and GCD*	*Identities*	*Percentage Problems*	*Simple Interest*	*Logarithms Rules*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S-4	SLO-1	*Vocabulary enrichment techniques*	*Contextual Vocabulary Exercise - Synonyms*	*Sentence Completion Basic Level Exercises – Double Blank*	*Reading Comprehension – Summary & Main Idea*	*Sentence Completion - Grammar*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S-5	SLO-1	*Unit digit, Number of zeroes, Factorial notation*	*Fractions and Decimals, surds*	*Profit and Loss*	*Compound Interest, Installments*	*Linear Equations*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S-6	SLO-1	*Vocabulary enrichment Techniques*	*Contextual Vocabulary Exercise - Antonyms*	*Cloze Test*	*Reading Comprehension – Summary & Main Idea*	*Spotting Errors*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*

Learning Resources	1. *Nishit K. Sinha, The Pearson Guide to Quantitative Aptitude and Data Interpretation for the CAT* 2. *Dinesh Khattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations* 3. *Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Random House Reference, 2002* **4.** *Merriam Webster's Vocabulary Builder, Merriam Webster Mass Market, 2010*	5. *Norman Lewis, How to Read Better and Faster, Goyal, 4th Edition* 6. *Franklin GRE Word List, 3861 GRE Words, Franklin Vocab System, 2014Wiley's GMAT Reading Comprehension Grail, Wiley, 2016* 7. *Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition* 8. *Martin Hewings, Advanced Grammar in Use. Cambridge University Press, 2013*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
Level 2	Apply Analyze	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*
Level 3	Evaluate Create	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
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2. Mr Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	*2. Dr. Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com*	*3. Mr Jayapragash J, SRMIST*	*4. Mrs. Rukmani, SRMIST*

Course Code	18PDM201L	Course Name	COMPETENCIES IN SOCIAL SKILLS	Course Category	*M*	*Mandatory*	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*enable students understand subtle meanings of words used in academic texts*			
CLR-2 :	*determine the grammatical, syntactical, and logical accuracy of sentences*			
CLR-3 :	*comprehend an argument's line of reasoning*			
CLR-4 :	*understand the structure, organization, tone, and main idea behind the passage*			
CLR-5 :	*recognize the logical coherence of ideas in a text*			
CLR-6 :	*give the right knowledge, skill and aptitude to face any competitive examination*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*build vocabulary through methodical approaches and nurture passion for enriching vocabulary*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
CLO-2 :	*detect and correct any grammatical, syntactical, and logical fallacies*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
CLO-3 :	*hone critical thinking skills by analyzing arguments with explicit and implicit premises to validate the author's point of view*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
CLO-4 :	*analyze and evaluate texts critically in multifarious ways*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
CLO-5 :	*identification of relationships between sentences based on their function, usage and characteristics*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
CLO-6 :	*ace competitive examinations*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Synonyms in Isolation and Context*	*Spotting Errors – Level I*	*Critical Reasoning – Weakening*	*Reading Comprehension – Main Idea*	*Para Jumble-Type I*
	SLO-2	*Practice*	*Practice*	*Practice*	*Practice*	*Practice*
S-2	SLO-1	*Antonyms in Isolation and Context*	*Spotting Errors – Level II*	*Critical Reasoning – Inference*	*Reading Comprehension – Tone*	*Para Jumble-Type II*
	SLO-2	*Practice*	*Practice*	*Practice*	*Practice*	*Practice*
S-3	SLO-1	*Common Confusables*	*Spotting Errors – Level II*	*Critical Reasoning – Conclusion*	*Reading Comprehension – Inference*	*Para Jumble-Type III*
	SLO-2	*Practice*	*Practice*	*Practice*	*Practice*	*Practice*
S-4	SLO-1	*Cloze Passage*	*Sentence Correction-Type I & II*	*Critical Reasoning - Explain the paradox*	*Reading Comprehension – Summary*	*Para Completion*
	SLO-2	*Practice*	*Practice*	*Practice*	*Practice*	*Practice*
S-5	SLO-1	*Word Analogy*	*Sentence Correction-Type III & IV*	*Critical Reasoning – Miscellaneous*	*Reading Comprehension – Conclusion*	*Para Completion*
	SLO-2	*Practice*	*Practice*	*Practice*	*Practice*	*Practice*

S-6	SLO-1	*Sentence Completion*	*Sentence Correction-Type V& VI*	*Critical Reasoning – Miscellaneous*	*Reading Comprehension – Miscellaneous*	*Para Summary*
	SLO-2	*Practice*	*Practice*	*Practice*	*Practice*	*Practice*

Learning Resources	1. *Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Random House Reference, 2002* 2. *Merriam Webster's Vocabulary Builder, Merriam Webster Mass Market, 2010* 3. *Norman Lewis, How to Read Better and Faster, Goyal, 4th Edition* 4. *Franklin GRE Word List, 3861 GRE Words, Franklin Vocab System, 2014* 5. *Wiley's GMAT Reading Comprehension Grail, Wiley, 2016*	6. *Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition* 7. *Martin Hewings, Advanced Grammar in Use. Cambridge University Press, 2013* 8. *Manhattan GMAT – Critical Reasoning, GMAT Strategy Guide, 12th Edition* 9. *Joern Meissner, Manhattan Review, GRE Analytical Writing Guide, Manhattan Review Inc, 2011* 10. *GRE Analytical Writing, Solutions to the Real Essay Topics (Test Prep. Series), Vibrant Publishers, 2011*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-
Level 2	Apply Analyze	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-
Level 3	Evaluate Create	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Mr. Vijay Nayar, Director, Education Matters, vijayn@edumat.com	*1. Dr. Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com*	*1. Dr. M. Snehalatha, SRMIST*	*3. Dr. P. Madhusoodhanan, SRMIST*
2. Mr. Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	*2. Mr. Nishith Sinha, due North India Academics LLP, nsinha.alexander@gmail.com*	*2. Mr Jayapragash J., SRMIST*	*4. Mr. Clement A, SRMIST*

Course Code	18PDM202L	Course Name	CRITICAL AND CREATIVE THINKING SKILLS	Course Category	*M*	*Mandatory*	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*identify problems*			
CLR-2 :	*recognize the logical coherence of ideas*			
CLR-3 :	*understand the structure and principles of writing*			
CLR-4 :	*interpret the structure, organization, tone, and main idea of the content*			
CLR-5 :	*hone comprehension skills*			
CLR-6 :	*give the right knowledge, skill and aptitude to face any competitive examination*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*solve problems*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-2 :	*grasp the approaches and strategies to find solutions*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-3 :	*organize and articulate ideas clearly*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-4 :	*analyze and evaluate contents critically in multifarious ways*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-5 :	*understand, comprehend and provide logical conclusions*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
CLO-6 :	*gain appropriate skills to succeed in preliminary selection process for recruitment*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Ages*	*Permutations-Types*	*Probability-Intro*	*Logical Reasoning – Blood relations, Directions*	*Information Ordering - Analogy*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Series completion*	*Math operations*
S-2	SLO-1	*Case Study*	*Statement Completion*	*Principles of Writing*	*Reading Comprehension – Bold Faced*	*Para Completion*
	SLO-2	*Discussion*	*Practice*	*Practice*	*Practice*	*Practice*
S-3	SLO-1	*Quadratic Equations*	*Combination-Concepts*	*Probability theory -Applications*	*Logical Reasoning- Cubes*	*Analytical Reasoning-Intro*
	SLO-2	*In-equations*	*Solving Problems*	*Solving Problems*	*Logical Reasoning-syllogism*	*Analytical Reasoning - Level I*
S-4	SLO-1	*Case Study*	*Statement Completion*	*Principles of Writing*	*Reading Comprehension – Bold Faced*	*Para Completion*
	SLO-2	*Discussion*	*Practice*	*Practice*	*Practice*	*Practice*
S-5	SLO-1	*Permutations-Concepts*	*Combination- Miscellaneous*	*Logical Reasoning – Coding and Decoding*	*Information Ordering - Arrangements*	*Analytical Reasoning-Level II*
	SLO-2	*Solving Problems*	*Solving Problems*	*Practice*	*Practice*	*Analytical Reasoning - Level III*

S-6	SLO-1	*Case Study*	*Statement Completion*	*Principles of Writing*	*Reading Comprehension – Miscellaneous*	*Para Completion*
	SLO-2	*Discussion*	*Practice*	*Practice*	*Practice*	*Practice*

Learning Resources	1. *Dinesh Khattar-The Pearson Guide to Quantitative Aptitude for competitive examinations* 2. *Hari Mohan Prasad, Verbal Ability for Competitive Examinations, Tata McGraw Hill Publications* 3. *Edgar Thrope, Test of Reasoning for Competitive Examinations, Tata McGraw Hill, 4th Edition, 2012* 4. *Norman Lewis, Word Power Made Easy, W.R. Goyal Publications, 2011*	5. *Ellet William, The Case Study Handbook: How to read, discuss, and write persuasively about cases* 6. *Manhattan GMAT – Critical Reasoning, GMAT Strategy Guide, 12th Edition* 7. *Wiley's GMAT Reading Comprehension Grail, Wiley, 2016* 8. *Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-
Level 2	Apply Analyze	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-
Level 3	Evaluate Create	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Course Code	18PDM203L	Course Name	ENTREPRENEURIAL SKILL DEVELOPMENT	Course Category	*M*	*Mandatory*	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*gain knowledge about Entrepreneurship*			
CLR-2 :	*study mindsets of Entrepreneur*			
CLR-3 :	*assimilate skills and behavioral aspects of entrepreneurship*			
CLR-4 :	*generate creative and innovative ideas*			
CLR-5 :	*acquire knowledge about the entrepreneurial processes*			
CLR-6 :	*develop entrepreneurial skills*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Understand the concept of Entrepreneurship and Entrepreneur*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-2 :	*Comprehend the mindset of Entrepreneurs*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-3 :	*Understand the skills and behavioral aspects required in Entrepreneurs*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-4 :	*Analyze the role of Creativity and Innovation in their Entrepreneurial journey*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-5 :	*Create and present their Business Model*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
CLO-6 :	*Acquire entrepreneurial skills*	*1*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Introduction*	*Motivation*	*Self Analysis*	*Negotiating skill*	*Business Model Canvas*
	SLO-2	*Benefits of entrepreneurship*	*External and internal*	*SWOT*	*People Management*	*Business Model Canvas*
S-2	SLO-1	*Origin of Entrepreneurship*	*Theories of Entrepreneurship*	*Communication*	*Creativity*	*Business Opportunity Identification*
	SLO-2	*Evolution of Entrepreneurship*	*Theories of Entrepreneurship*	*Networking*	*Idea Generation*	*Business Opportunity Identification*
S-3	SLO-1	*Social and Economic factors Influencing Entrepreneurship*	*Success Stories – Case Study Analysis*	*Interpersonal skills*	*Problem Solving*	*Business Model canvas presentation*
	SLO-2	*Environment and Psychological factors Influencing Entrepreneurship*	*Success Stories – Case Study Solution*	*Collaborative skills*	*Problem solving*	*Business Model canvas presentation*
S-4	SLO-1	*Myths about entrepreneurship*	*Success Stories – Case Study Analysis*	*Team management skills*	*Decision Making*	*Business Model canvas presentation*
	SLO-2	*Myths about entrepreneurship*	*Success Stories – Case Study Solution*	*Team management skills*	*Six Thinking hats*	*Business Model canvas presentation*
S-5	SLO-1	*Entrepreneurship Failures*	*Risk-taking Behavior*	*Leadership*	*Inventions*	*Business model presentation*

	SLO-2	*Entrepreneurship Failures*	*Resilience*	*Shared leadership*	*Inventions*	*Business model presentation*
S-6	SLO-1	*Entrepreneurship in India – A Preview*	*Global Markets for Entrepreneurs*	*Time Management*	*Innovations*	*Business model presentation*
	SLO-2	*Indian Entrepreneurships*	*Understanding the cross cultural behaviors and differences*	*Prioritisation*	*Innovations*	*Business model presentation*

Learning Resources	1. *Elon Musk – Ashley Vance- Virgin Books-2015* 2. *Think and Grow Rich – Napolean Hill - The Ralston Society – 1937* 3. *The Lean Startup – Eric Ries - Crown Publishing Group (USA) – 2011* 4. *The $100 Startup – Chris Gullibeau - Crown Business- 2012* 5. *Creativity, Innovation, and Entrepreneurship: The Only Way to Renew Your Organization - H. James Harrington - Productivity Press- December 2018*	6. *www.wfnen.org; National Entrepreneurship Network – Wadhwani Foundation* 7. *https://www.forbes.com/sites/.../2017/.../top-entrepreneur-stories-to-inspire-you-in-2017/* 8. *https://bizztor.com/in/successful-indian-entrepreneurs-stories* 9. *https://www.entrepreneur.com/article/299214* 10. *https://www.fundera.com/blog/young-entrepreneurs* 11. *The Entrepreneurs: Success and Sacrifice - by Kip Marlow* *cbseacademic.nic.in/web material/Curriculum19/Main.../20_Entrepreneurship.pdf*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-
Level 2	Apply Analyze	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-
Level 3	Evaluate Create	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Course Code	18PDM204L	Course Name	BUSINESS BASICS FOR ENTREPRENEURS	Course Category	*M*	*Mandatory*	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Provides a base of Managerial application skills that enable students to understand practical managerial concepts*			
CLR-2 :	*Comprehend business models*			
CLR-3 :	*Understand different accounting concepts*			
CLR-4 :	*Understand the taxation and tax laws*			
CLR-5 :	*Understand the process of design thinking*			
CLR-6 :	*Acquire knowledge on business skills*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Explain the nature and purpose of marketing; understand the fundamentals of each of the most important marketing tasks*	*1*	*80*	*75*
CLO-2 :	*Use the Business Models in their startups*	*1*	*80*	*75*
CLO-3 :	*Identify and appreciate the strong linkages between finance and globalization*	*2*	*80*	*75*
CLO-4 :	*Implement tax process*	*2*	*80*	*75*
CLO-5 :	*Acquire Design Thinking concepts to implement in the startup*	*1*	*80*	*75*
CLO-6 :	*Implement the essential business basics*	*3*	*80*	*75*

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
L	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
L	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-

		Marketing Management	Business Models	Financial Management	Costing and Taxation	Design Thinking
Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Introduction to Marketing Management*	*Business Models for startups*	*Introduction to Finance Management*	*Pricing Strategies*	*Design Thinking*
	SLO-2	*Understand the market*	*Introduction to SAAS*	*Effective and efficient management of money*	*Pricing for market penetration*	*Developing design concepts*
S-2	SLO-1	*6 P's of Marketing*	*Business model*	*Accounting Process*	*Types of Pricing*	*Five stages of design concepts*
	SLO-2	*5 P's of Marketing*	*Introduction to PAAS*	*Four steps in business transactions*	*Pricing strategies*	*Super charging with design thinking*
S-3	SLO-1	*Introduction to Consumer Behavior*	*Revenue Models*	*Basic Accounting Procedures*	*Introduction to MIS*	*Creating concepts*
	SLO-2	*Create value proposition*	*Application of revenue models*	*Basic book keeping for financial transactions*	*Data Analysis*	*Creating concepts*
S-4	SLO-1	*Types of Marketing*	*Outsourcing Models*	*Financial Statements*	*Taxation*	*Hackathon / Challenge Labs*
	SLO-2	*Business marketing concepts*	*Partnership Models*	*Profit and Loss account, Balance sheet Statement of cash flow*	*Taxation*	*Hackathon / Challenge Labs*

S-5	SLO-1	*Market Segmentation*	*Profitability*	*Working Capital Management*	*Tax laws*	*Hackathon / Challenge Labs*
	SLO-2	*Market Positioning*	*Business Metrics*	*Utilizing current assets and current liabilities for efficient operation*	*Tax laws*	*Hackathon / Challenge Labs*
S-6	SLO-1	*Branding*	*Business Model Analysis*	*Financial Ratios*	*Case studies and Problem Solving*	*Hackathon / Challenge Labs*
	SLO-2	*Creating USP*	*Practical Implementation*	*Profitability, Liquidity, Operating, Leverage*	*Case studies and Problem Solving*	*Hackathon / Challenge Labs*

Learning Resources	1. *Elon Musk – Ashley Vance- Virgin Books-2015* 2. *Think and Grow Rich – Napolean Hill - The Ralston Society – 1937* 3. *The Lean Startup – Eric Ries - Crown Publishing Group (USA) – 2011* 4. *The $100 Startup – Chris Gullibeau - Crown Business- 2012* 5. *Creativity, Innovation, and Entrepreneurship: The Only Way to Renew Your Organization - H. James Harrington - Productivity Press- December 2018*	6. *www.wfnen.org; National Entrepreneurship Network – Wadhwani Foundation* 7. *https://www.forbes.com/sites/.../2017/.../top-entrepreneur-stories-to-inspire-you-in-2017/* 8. *https://bizztor.com/in/successful-indian-entrepreneurs-stories* 9. *https://www.entrepreneur.com/article/299214* 10. *https://www.fundera.com/blog/young-entrepreneurs* 11. *The Entrepreneurs: Success and Sacrifice - by Kip Marlow* *cbseacademic.nic.in/web material/Curriculum19/Main.../20_Entrepreneurship.pdf*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Understand										
Level 2	Apply	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-
	Analyze										
Level 3	Evaluate	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Course Code	18PDM301L	Course Name	ANALYTICAL AND LOGICAL THINKING SKILLS	Course Category	M	*Mandatory*	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Recapitulate fundamental mathematical concepts and skills*			
CLR-2 :	*Sharpen logical reasoning through skillful conceptualization*			
CLR-3 :	*Enable to solve problems and to crack competitive exams.*			
CLR-4 :	*understand and master the mathematical concepts to solve types of problem*			
CLR-5 :	*identify problems*			
CLR-6 :	*give the right knowledge, skill and aptitude to face any competitive examination*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*build a strong base in the fundamental mathematical concepts*	*1*	*80*	*75*	*L*	*H*		*M*					*M*	*L*		*H*			
CLO-2 :	*Apply the learn conditions towards solving problems analytically*	*1*	*80*	*75*	*L*	*H*		*M*					*M*	*L*		*H*			
CLO-3 :	*grasp the approaches and strategies to solve problems with speed and accuracy*	*2*	*80*	*75*	*L*	*H*		*M*					*M*	*L*		*H*			
CLO-4 :	*Collectively solve problems in teams and groups*	*2*	*80*	*75*	*L*	*H*		*M*					*M*	*L*		*H*			
CLO-5 :	*solve problems*	*1*	*80*	*75*	*L*	*H*		*M*					*M*	*H*		*H*			
CLO-6 :	*gain appropriate skills to succeed in preliminary selection process for recruitment*	*3*	*80*	*75*	*L*	*H*		*M*					*M*	*H*		*H*			

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Arithmetic Progression*	*Clocks*	*Time, Speed, Distance*	*Geometry - Triangles*	*Data sufficiency Introduction*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Geometry – Lines and Angles*	*Data sufficiency Type 1*
S-2	SLO-1	*Geometric Progressions*	*Calendar*	*Time, Speed, Distance-Races*	*Geometry - Circles*	*Data sufficiency Type 2*
	SLO-2	*Harmonic Progression*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S-3	SLO-1	*Averages*	*Ratio*	*Problems on Trains*	*Mensuration Area*	*Data Interpretation - Introduction*
	SLO-2	*Solving Problems*	*Proportion*	*Solving Problems*	*Solving Problems*	*Data Interpretation - Table*
S-4	SLO-1	*Weighted Averages*	*Variation*	*Boats & Streams*	*Mensuration – Volume and Surface Area*	*Data Interpretation - Pie Chart*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Data Interpretation - Line Graphs*
S-5	SLO-1	*Sets Two Variables*	*Mixtures & Solutions*	*Time and work*	*Trigonometry- Identities*	*Data Interpretation – Bar Graphs*
	SLO-2	*Sets Three Variables*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S-6	SLO-1	*Functions*	*Allegation Method*	*Pipes and Cisterns*	*Trigonometry - Height and Distances*	*Revision I*
	SLO-2	*Graphs*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Revision II*

Learning Resources	
	1. *Abhijit Guha, Quantitative Aptitude for Competitive Examinations,Tata McGraw Hill, 3rd Edition, 2011*
	2. *Arun Sharma-Quantitative aptitude for CAT, Tata McGraw Hill*
	3. *Dinesh Khattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations.*
	4. *Edgar Thrope, Test of Reasoning for Competitive Examinations, Tata McGraw Hill, 4th Edition, 2012*
	5. *Archana Ram, Placementor, Oxford University Press,2018*
	6. *P.A.Anand, Quantitative Aptitude for Competitive Examinations, Wiley Publication, 2016*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Understand										
Level 2	Apply	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-
	Analyze										
Level 3	Evaluate	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr Nishith Sinh, dueNorth India Academics LLP, Dehradun, nsinha.alexander@gmail.com		*1. Dr.P.Madhusoodhanan SRMIST*
2. Mr Ajay Zenne, Career Launcher, ajay.z@careerlauncher.com		*2. Dr.M.Snehalatha SRMIST*
3. Mr.Pratap Iyer, Study Abroad Mentors, Mumbai, pratap.iyer30@gmail.com		*3. Mr Murali K SRMIST*
		4. Mr.Harinarayana Rao SRMIST

Course Code	18PDM302L	Course Name	ENTREPRENEURSHIP MANAGEMENT	Course Category	M	*Mandatory*	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Business Basics for Entrepreneurs*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Provide the knowledge of Legal Systems and trains the students in application skills that enable students to understand the Law and Legal management concepts.*			
CLR-2 :	*Comprehend and Practice Ethical Governance*			
CLR-3 :	*Understand different HRM concepts*			
CLR-4 :	*Understand Project Management and its application*			
CLR-5 :	*Use the Project Management skills learnt in the entrepreneurial venture*			
CLR-6 :	*Acquire knowledge on validation and Launch of startup*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Acquire knowledge about the Business law, legal procedures, Intellectual Properties and patents.*	*1*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-2 :	*Learn the role of government in supporting entrepreneurship to develop the society as well as the role of an entrepreneur as an individual with the government.*	*1*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-3 :	*Identify and be able to critically analyze the regulation of governance including that in national and international codes of practice, legislation, common law, norms of practice and ethics.*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-4 :	*Evaluate the effectiveness of HRM practices in supporting the strategic and operational needs of the startup.*	*2*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-5 :	*Adapt project management practices to meet the needs of stakeholders from multiple sectors of the economy.* *Apply project management practices to the launch of new programs, initiatives, products, services, and events relative to the needs of stakeholders.*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-
CLO-6 :	*Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.*	*3*	*80*	*75*	*L*	*H*	-	*M*	-	-	-	-	*M*	*H*	-	*H*	-	-	-

		Law and Legal Systems	Impact of Governance on ED	HRM	Entrepreneurial Project Management	Project Validation and Launch
Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Introduction to Law and Legal Systems*	*Corporate Governance for Startups*	*HRM – Introduction and Overview*	*Project Management and Entrepreneurship -Introduction*	*Entrepreneur – Pitching the idea "Pitch Fest 01"*
	SLO-2	*Types of Laws and its Impact*	*Governance Structure and Practice*	*Role of HRM in entrepreneurship development*	*Project Management and Entrepreneurship – Concepts and Process*	*Entrepreneur – Pitching the idea "Pitch Fest 02"*
S-2	SLO-1	*Contractual Law*	*Government Programs*	*Functions of HRM*	*Project Management – Aims and Objectives*	*Entrepreneur – Pitching the idea "Pitch Fest 03"*
	SLO-2	*Dispute Resolution*	*Public Policy and its impact on Startups*	*Challenges of Performance and Appraisal in Startups*	*Review of Best Projects – Startup India*	*Entrepreneur – Pitching the idea "Pitch Fest 04"*
S-3	SLO-1	*Intellectual Property Rights - Introduction*	*Market and Institutional mechanisms in Governance*	*HRM - Models and Systems*	*Project Formulation – Concepts and Processed*	*Idea Valuation and Assessment 01*

	SLO-2	*Intellectual Property Rights - Types and Trademarks*	*Ethics in Governance*	*Cultures and Value system for startups*	*Importance and Implementation – Project Formulation*	*Idea Valuation and Assessment 02*
S-4	SLO-1	*Patent Law - Introduction*	*Measuring business performance*	*Employee Motivation*	*Entrepreneurial Project Process Life Cycle - Introduction*	*Project Creation and Setup*
	SLO-2	*Rules and Regulations for Patenting*	*Financial growth for Startups*	*Employee Engagement and Development*	*Entrepreneurial Project Process Life Cycle – Concepts and Methods*	*Project Validation and Assessment*
S-5	SLO-1	*Company Law and Regulations*	*Governance Model for Startups*	*HRM – Key challenges n strategies*	*Project Boundaries and Integration*	*Final Project Launch 01*
	SLO-2	*Types of Companies*	*Structuring Governance for your startup*	*Employee Safety and Security – HRM*	*Core Functionalities in Project Implementation*	*Final Project Launch 02*
S-6	SLO-1	*Business Incorporation – Startup India*	*Risk Management*	*Best HR practices for a startup*	*Stakeholder Management*	*Final Project Launch 03*
	SLO-2	*Make In India*	*Entrepreneurial Risks and its Impact*	*Review for Best Practises in Startup*	*Stakeholder Engagement and analysis*	*Final Project Launch 04*

Learning Resources	1. *www.wfnen.org; National Entrepreneurship Network – Wadhwani Foundation* 2. *https://www.forbes.com/sites/.../2017/.../top-entrepreneur-stories-to-inspire-you-in-2017/* 3. *https://bizztor.com/in/successful-indian-entrepreneurs-stories* 4. *https://www.entrepreneur.com/article/299214* 5. *https://www.fundera.com/blog/young-entrepreneurs* 6. *The Entrepreneurs: Success and Sacrifice - by Kip Marlow* cbseacademic.nic.in/web_material/Curriculum19/Main.../20_Entrepreneurship.pdf	7. *Elon Musk – Ashley Vance- Virgin Books-2015* 8. *Think and Grow Rich – Napolean Hill - The Ralston Society – 1937* 9. *The Lean Startup – Eric Ries - Crown Publishing Group (USA) – 2011* 10. *The $100 Startup – Chris Gullibeau - Crown Business- 2012* 11. *Creativity, Innovation, and Entrepreneurship: The Only Way to Renew Your Organization - H. James Harrington - Productivity Press- December 2018*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Understand										
Level 2	Apply	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-
	Analyze										
Level 3	Evaluate	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Vijay Nayar, Director, Education Matters, vijayn@edumat.com	*Mr. Ashok Kumar V – Professor, NITTE School Of Management Entrepreneurship Development, ashokkumarvv2007@gmail.com*	*Dr. Shantanu Patil, Professor and Head of Department, Department of Translational Medicine and Research, Shantanu.s@ktr.srmuniv.ac.in*
Mr. Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	*Dr. A.K. Sheik Manzoor, Anna University, sheikmanzoor@annauniv.edu*	*Dr. Revathi Venkataraman, Professor, Department of Computer Science and Engineering, revathi.n@ktr.srmuniv.ac.in*
		Mr. Ananth Kumar, Assistant Professor (Mgmt.) & Executive Secretary, psecy.director.et@srmuniv.ac.in
		Mrs. Deepa Narayanan *Assistant Professor – CDC, deepa.na@ktr.srmuniv.ac.in*

Course Code	18LEM110L	Course Name	INDIAN ART FORM	Course Category	M	*Mandatory*	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English and Foreign Languages*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Introduce the learners to the changing art forms in different periods of time: richness, variety and significance of various Indian art forms*			
CLR-2 :	*Enable the students to recognize and appreciate paintings of different schools prevalent in the different geographical locations*			
CLR-3 :	*Draw the learner's attention towards the various types of sculpture based on the materials used and the themes behind them*			
CLR-4 :	*Cultivate a sense of appreciation about the aesthetics of drawing as an integral part of our daily life*			
CLR-5 :	*Orient the learners about the changing Indian social scenario and the ways they are reflected in the changing facets of Modern Indian Art Forms*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*equip with an awareness of the rich cultural heritage of India*	*3*	*90*	*85*
CLO-2 :	*understand the contexts and significance of various Indian art forms*	*3*	*90*	*85*
CLO-3 :	*understand how the confluence of the diverse art forms of India create the mosaic of the Indian nation*	*3*	*90*	*85*

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
-	-	-	-	-	*H*	*M*	*H*	*H*	*H*	-	*H*	-	-	-
-	-	-	-	-	*H*	*M*	*M*	*H*	*H*	-	*H*	-	-	-
-	-	-	-	-	*H*	*M*	*H*	*H*	*H*	-	*H*	-	-	-

Duration (hour)		Indian Art over Ages - An Overview	Indian painting	Indian sculpture	The Indian Art of Floor Decoration	Modern Art
S-1	SLO-1	*Ancient India: An Overview*	*Indus Valley civilization paintings on pottery*	*Sculpture during the Harappan period*	*Kolam - the traditional floor drawing of South India*	*Nationalist School of Bengal Art-Introduction*
	SLO-2	*Raj-Ravi Verma: religious stories like mythologies of Hindu gods*	*Cave paintings from different parts of India*	*Terra Cota – What? Where? When? – A discussion*	*Daily life and Kolam - Line drawings, geometric designs and natural world - Some examples*	*Matching the picture with the artist*
S-2	SLO-1	*Mysore and Tanjore Art : included themes revolving around Hindu epics like Ramayana and Mahabharata*	*The paintings of the Ajanta and Ellora caves*	*Rock cut sculpture – Differences between rock cut sculpture and stone sculpture*	*Beliefs behind Kolam*	*Tracing the major ideas through paintings – Going back to Hindu themes*
	SLO-2	*Indian artists from different fields*	*Paintings of North India, South India, East India, West India, Central and Deccan India*	*Sculptures in religious buildings*	*Rangoli – Occasions and motifs*	*Student presentations on individual artists*
S-3	SLO-1	*Folk Art*	*Thanjavur, Madhubani paintings*	*Buddhism, Hinduism, and Jainism in sculpures*	*Kalamezhuthu in Kerala - Religious significance*	*Tracing the major ideas through paintings – Indian Village Life and nationalist themes*
	SLO-2	*Folk art and popular culture: classical and folk art*	*Analysing the recurrent themes style through selected illustrations*	*Visit to Mahabalipuram and submitting a report by the students*	*Mandana paintings of Rajasthan and Madhya Pradesh by oldest tribal communities*	*Student presentations on individual artists*
S-4	SLO-1	*Influential factors giving rise to modern art*	*Kalamkari paintings – Features of organic art; obtaining colours from natural sources*	*Bronze sculptures in India*	*Bengal's floor art-Alpona*	*European influences (British) – Trends in painting – portrait, landscape and realistic*

	SLO-2	*Concepts and Motifs behind modern art*	*Attempting simple Kalamkari/Madhubani paintings using natural colours*	*Cultural stonework in India - in the form of primitive cupule art*	*Festival specific Floor Art across India*	*Collection and display of paintings by various artists*
S-5	SLO-1	*Mughal paintings*	*Pattachitra paintings*	*the Buddhist Pillars of Ashoka of the Mauryan period*	*Festival specific Floor Art across India*	*British Gothic and Indo Saracenic architecture through examples*
	SLO-2	*Astonishing contemporary paintings by Indian artists*	*Students presenting and sharing their paintings*	*The figurative Greco-Buddhist sculpture of the Gandhara and Mathura schools, and the Hindu art of the Gupta period: Brief Introduction*	*Pookalam: The Onam Floral Rangoli*	*Field trip to places in Chennai which have Indo Saracenic architecture and report submission*
S-6	SLO-1	*Fairs, festivals and local deities in the development of art forms*	*Moghal paintings*	*Khajuraho Temples in Madhya Pradesh*	*Body Art: Traditional Mehendi*	*Indian Art post-Independence Progressive Artists' Group and their Influence*
	SLO-2	*myth, legends, snippets from epic, multitudinous gods born out of dream and fantasy in art forms*	*Moghal paintings from the various Moghal dynasties and identification of the common features*	*Debate on "Religion and Art Today"*	*Mehendi designs, religious and cultural significances*	*Fusion of western style and Indian themes*

Learning Resources	1. *Ketkar, Anil Rao Sandhya. The History of Indian Art (Paperback). Jyotsna Prakashan, 2017.* 2. *Chaturvedi, P. N. Encyclopedia of Indian Art and Architecture. M. D. Publications Pvt. Ltd., 2009.*	3. *Gupta, S. P. Elements of Indian Art:Including Temple Architecture, Iconography and Iconometry. D. K. World Ltd., 2006* 4. *Goswamy, B. N. Ed. Oxford Readings in Indian Art. OUP, 2018.* 5. *https://courses.lumenlearning.com/boundless-arthistory/chapter/contemporary-indian-art/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-
Level 2	Apply Analyze	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-
Level 3	Evaluate Create	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts

Course Code	18LEM109T	Course Name	INDIAN TRADITIONAL KNOWLEDGE	Course Category	M	*Mandatory*	L	T	P	C
							1	0	0	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English and Foreign Languages*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Introduce the learners to the early and traditional environmental friendly agricultural practices*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	*Enable the students to recognize and appreciate the contribution of India to astronomical studies*			
CLR-3 :	*Draw the learner's attention towards the holistic approach behind Indian system of medicine*			
CLR-4 :	*Cultivate a sense of appreciation about ancient Indian Engineering and Technology as diverse, culture and resource specific*			
CLR-5 :	*Develop an understanding about the connection of daily life to the environment and a healthy lifestyle through a comparison of the linguistic phrases and sayings and analyzing them from today's science*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning		
		1	2	3
CLO-1 :	*equip with an awareness of the ancient India's eco consciousness and India's contribution to astronomy and the beliefs associated with it*	*3*	*90*	*85*
CLO-2 :	*appreciate the Indian aesthetic sensibility which is evidenced in the architectural monuments, economic life and religious worship*	*3*	*90*	*85*
CLO-3 :	*understand how Indians have had a holistic approach towards human life integrating the body, mind and soul*	*3*	*90*	*85*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
-	-	-	-	-	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-
-	-	-	-	*L*	*H*	*M*	*M*	*H*	*H*	-	*H*	-	-	-
-	-	-	-	-	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-

Duration (hour)		Agriculture	Mathematics & Astronomy	Medicine	Engineering & Technology	Customs, Sayings And Life Truths
S-1	SLO-1	*Early agricultural settlements - Influencing Factors – locale and climate*	*Concepts of time and space - Knowledge of the Universe*	*Introduction to the school of Ayurveda, Siddha and Naturopathy:*	*Architecture – Temples, forts, palaces, houses and town planning*	*Regional myths, beliefs,,and cultural practices*
	SLO-2	*Locating the early agricultural settlements in the Indian map and indicating the timeline*	*Quiz based on the Indian concept of time and distance between the planets*	*Compare and Contrast of the methodologies, popular beliefs, myths and truths about medications*	*Group Discussions through examples from different historical periods and geographical locations*	*Noting the idioms, proverbs in mother tongues connected to seasons and festivals*
S-2	SLO-1	*Crop cultivation - Community based Environment friendly practices*	*Great astronomers and mathematicians of ancient India*	*Common features - Holistic Therapeutic Approach – Natural elements, individual constitution (Humours), and the balance recommended*	*Metallurgy – Coins, Traditional Indian Metal Carvings*	*Traditional Foods of India in accordance with the climate and availability of the resources*
	SLO-2	*Group presentations on the traditional agricultural practices in selected states*	*The respective contributions of Astronomers and Mathematicians*	*Understanding the rationale behind selected sample treatments provided or advised, Case Studies*	*Discussions on historical periods and their architectural influences*	*Collecting old sayings in specific regions of India*
S-3	SLO-1	*Ancient Indian Water management and irrigation methods*	*The planetary system and Indian Astrology: Basic Facts*	*Yoga and its Universal Appeal*	*Textile technology – Region / Culture specific Fiber, Fabric and weaving*	*Translating Regional sayings into English*
	SLO-2	*A region based study of natural water resources and aquifers and types of irrigation*	*Discussion on a few sample birth charts and predictions made*	*Discussions on worldwide popularity of Yoga and meditation*	*Comparing the Temple Architecture of North and Southern Indian States*	*Traditional sayings about Hygiene and practices pertaining to them*

Learning Resources	1. *V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014.* 2. *Basham, A.L. ed. A Cultural History of India. OUP, 1997.*	3. *Thapar, Romila. Indian Cultures as Heritage: Contemporary Past. Aleph Book Company, 2018.* 4. *GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016.*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts

Course Code	18CEM401J	Course Name	PROFESSIONAL ENHANCEMENT COURSE - I	Course Category	M	*Mandatory Courses*	L	T	P	C
							1	0	2	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*To introduce fundamentals of building design*
CLR-2 :	*Understanding architecture and suggest suitable structural scheme*
CLR-3 :	*To impart understanding of integrated design concepts including other trades in building construction*
CLR-4 :	*To train manual design for RCC and steel structures.*
CLR-5 :	*To train in using software and applications for designing RCC and Steel structures.*
CLR-6 :	*Awareness to be created in 3dimensional modelling, analysis and design.*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify various types of design for buildings*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-2 :	*Analyze the architectural view and structural design concepts*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-3 :	*Understand software and manual designs like beam, slab and column*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-4 :	*Analyze the steel structure as per IS 800-2007*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-5 :	*Understand about the steel design and its optimization*	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-6 :	*Understand about the 3D-7D planning.*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Structural Engineering concepts*	*Aligning with architecture, suitable structural scheme to suite architectural plans,*	*Using equivalent systems in manual analysis and computer analysis.*	*Wind loading considerations Seismic loading considerations*	*Integration of Structural Design*
	SLO-2		*Usage of transfer girders, long spans, irregular building configurations. usage of masonry structures*	*Designing for architectural features, loading pattern and building typologies based on usage parameters*	*Steel optimization method in design*	*Interface with other trades and services*
S-2	SLO-1	*Practical : Overview of structural analysis of building*	*Practical: load combination as per IS codes for proportioning members*	*Practical : Reinforcement detailing for RC elements – columns and beams*	*Practical: Bar bending details and scheduling*	*Practical: Drawing preparation*
S-3	SLO-1	*Practical : Overview of structural design of building*	*Practical : checking of pre and post analysis in software*	*Practical : Reinforcement detailing for RC elements – slabs, staircases etc.*	*Practical : Performing steel structure design as per IS800- 2007*	*Practical: Drawing preparation*
S-4	SLO-1	*Classification of Structures*	*Loading definition and equivalent static methods .Using equivalent systems in manual analysis and computer analysis.*	*Manual design for slabs as per IS456 2000*	*Reinforcement ductile detailing as per IS 13920 - 2016*	*BIM and its uses*
S-5	SLO-1	*Practical : Load calculations of real buildings*	*Practical: Using software's for automated seismic and wind loading*	*Practical: Design of Beams and Columns using software*	*Practical :Seismic detailing practices*	*Practical: construction interfacing*
S-6	SLO-1	*Practical : Load calculations of special structures like bridges as per IRC codes*	*Practical : Manual design for beams and columns as per IS456 2000*	*Practical: Using software's for slab modeling and analysis*	*Practical : Usage of Custom spreadsheets*	*Practical 3D to 7D& planning*

Learning Resources	1. *Varghese.P.C, "Limit State Design Of Reinforced Concrete", 2nd Ed,PHI Learning Pvt. Ltd., 2004* 2. *Francis .D.K Ching- "Architecture: Form Space & Order" Van Nastrand Reinhold, 1996* 3. *Subramanian.N, "Design of Steel Structures-Limit State Method", Oxford University Press, New Delhi, 2016.*	4. *https://www.bentley.com/en/products/brands/staad* 5. *https://www.csiamerica.com/products/etabs* 6. *https://www.csiamerica.com/products/sap2000* 7. *Prasanna Chandra, "Projects -Planning Analysis Selection Implementation & Review", Fourth Edition,. Tata McGraw Hill Publishing Company Ltd., New Delhi.2005.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	-	-
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	-	-
Level 3	Evaluate Create	*10%-*	*10%-*	*10%-*	*10%-*	*10%-*	*10%-*	*10%-*	*10%-*	-	-
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*1. Dr. R. Santhakumar, Professor, Centre for Rulal Department, NITTTR*	*Prof. G. Augustine Maniraj Pandian, SRMIST*
2. Er. G. Hariharanath, GA Consultants, Chennai, gac1996@hotmail.com	*2. Dr. P. Jayabalan, NIT, Trichy, pjeya@nitt.edu*	*Dr. K.S. Satyanarayanan, SRMIST*

Course Code	18CEM402T	Course Name	PROFESSIONAL ENHANCEMENT COURSE - II	Course Category	M	*Mandatory Course*	L	T	P	C
							1	0	0	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Create insights into various post tensioning elements.*			
CLR-2 :	*Address concepts related to prefabricated buildings*			
CLR-3 :	*Analyze concepts of BIM, 3D printing and recent trends*			
CLR-4 :	*Address concepts related to LIDAR, UAV, SAR and its recent trends*			
CLR-5 :	*Create insights into Scatterometry and polorimetry applications*			
CLR-6 :	*Analyze concepts of soil strengthening and stabilization.*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Analyse Post tensioning sections and design of elements.*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-2 :	*Understand Prefabricated structural buildings*	*2*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-3 :	*Understand recent trends in BIM, Top down construction and sustainability in construction.*	*1*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-4 :	*Analyse about waste management and environmental impact assessment.*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-5 :	*Understand recent trends in SAR, LIDAR etc:*	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-6 :	*Analyze about the soil strengthening and recent trends in soil stabilization.*	*2*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	*H*	-

Duration (hour)		3	3	3	3	3
S-1	SLO-1	Structural Engineering – Post Tensioning	CEM : Top down construction,BIM,3D printing	Environmental impact assessment	Empherical and semi empherical modelling of SAR	Trends interferometry in land slide application and recent trends.
S-2	SLO-2	Prefabricated structural design	Safety and other recent trends, Sustainability in construction, OR in CEM	Hazardous waste management – rain harvesting.	ANN in optimization in SAR, Altimetry for ocean studies and geoidal modelling	Soil strengthening measures , Geosynthesis
S-3	SLO-3	Recent trends in structural engineering	Water resources and Environmental Engineering, Climate change and impacts	Remote sensing and GIS : LIDAR,UAV	Scatterometry and polorimetry applications and recent trends	Biotechnology , slope stabilization and other recent trends

Learning Resources	
	1. *Krishnaraju .N, "Prestressed Concrete", Tata McGraw-Hill Education, 2008, New Delhi*
	2. *Laszlo Mokk, "Prefabricated Concrete for Industrial and Public Structures", AkademiaiKiado, Budapest, 2007.*
	3. *Kumar NeerajJha, "Construction project management", Dorling Kindersley,New Delhi.2013*
	4. *"Decision making and operations research techniques for construction management". C.m.tam, thomask.l.tongh.zhang*
	5. *Asawa .G.L, "Irrigation and Water Resources Engineering", New Age International Publishers, New Delhi, 2005*
	6. *"Decision making and operations research techniques for construction management". C.m.tam, thomask.l.tongh.zhang*
	7. *Charles J.Kibert,"Sustainable Construction: Green Buildings Design And Delivery", John Wiley & Sons, 2005*
	8. *Paneerselvam .R "Environmental Engineering", Vol. I, SPGS Publishers Chennai, 2010*
	9. *Anji Reddy .M, "Remote sensing and Geographical information system," B.S Publications*
	10. *Terzaghi K., Peck R.B., Soil Mechanics in Engineering Practice, John Wiley Ltd., 1967*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*1. Dr. R. Santhakumar, Professor, Centre for Rulal Department, NITTTR*	*1. Dr. K.S. Satyanarayanan, SRMIST*
2. Er. G. Hariharanath, GA Consultants, Chennai, gac1996@hotmail.com	*2. Dr. P. Jayabalan, NIT, Trichy, pjeya@nitt.edu*	*2. Mr. N. Parthasarathi, SRMIST*

Course Code	18PDM101L	Course Name	PROFESSIONAL SKILLS AND PRACTICES	Course Category	M	*Mandatory*	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize success habits to improve achievement in life*			
CLR-2 :	*Develop inter personal skills and be an effective goal oriented team player to achieve success*			
CLR-3 :	*Utilize professionalism with idealistic, practical and moral values that govern the behavior*			
CLR-4 :	*Become an expert in communication and problem solving skills*			
CLR-5 :	*Re-engineer attitude required to succeed and understand its influence on behavior to achieve professionalism*			
CLR-6 :	*Enhance holistic development of students and improve their employability skills*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Identify success habits*	*2*	*80*	*75*
CLO-2 :	*Acquire inter personal skills and be an effective goal oriented team player*	*2*	*75*	*70*
CLO-3 :	*Develop professionalism with idealistic, practical and moral values*	*2*	*80*	*75*
CLO-4 :	*Acquire communication and problem solving skills.*	*2*	*75*	*70*
CLO-5 :	*Re-engineer their attitude and understand its influence on behavior*	*2*	*85*	*80*
CLO-6 :	*Apply behavior changing elements to construct professionalism in character and behavior*	*2*	*85*	*80*

		Program Learning Outcomes (PLO)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify success habits*	-	-	-	-	-	-	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-2 :	*Acquire inter personal skills and be an effective goal oriented team player*	-	-	-	-	-	-	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*Develop professionalism with idealistic, practical and moral values*	-	-	-	-	-	-	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-4 :	*Acquire communication and problem solving skills.*	-	-	-	-	-	-	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*Re-engineer their attitude and understand its influence on behavior*	-	-	-	-	-	-	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-6 :	*Apply behavior changing elements to construct professionalism in character and behavior*	-	-	-	-	-	-	*H*	*H*	*H*	*H*	-	*H*	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Personality profiling*	*Etiquette and Grooming*	*Surveying and Reporting*	*Profile building*	*Innovation*
	SLO-2	*Being Proactive*	*Etiquette and Grooming*	*Surveying and Reporting*	*Profile building*	*Innovation*
S-2	SLO-1	*Begin with the end in mind*	*Collaborative skills*	*Projects*	*Personal Branding*	*Innovation*
	SLO-2	*Putting first things first*	*Collaborative skills*	*Projects*	*Personal Branding*	*Innovation*
S-3	SLO-1	*Thinking Win-Win*	*Networking skills*	*Paper presentations*	*Personal Branding*	*Creativity and out of box thinking*
	SLO-2	*Seeking first to understand and then to be understood*	*Networking skills*	*Paper presentations*	*Personal Branding*	*Creativity and out of box thinking*
S-4	SLO-1	*Synergizing*	*Team work and Support*	*Introduction to design thinking*	*USP*	*Creativity and out of box thinking*
	SLO-2	*Sharpening the saw*	*Team work and Support*	*Introduction to design thinking*	*USP*	*Creativity and out of box thinking*
S-5	SLO-1	*Character building*	*Leadership Skills*	*Generate ideas that are potential solutions to the problem identified*	*Developing profile*	*Six thinking hats*
	SLO-2	*IKIGAI*	*Leadership Skills*	*Generate ideas that are potential solutions to the problem identified*	*Developing profile*	*Six thinking hats*

S-6	SLO-1	*Self-worth*	*Leadership Styles*	*Report writing*	*Developing profile*	*Six thinking hats*
	SLO-2	*Attitude*	*Leadership Styles*	*Report writing*	*Developing profile*	*Six thinking hats*

Learning Resources	*1. Charles Harrington Elstor, Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998*	*2. Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972* *3. Carol Dweck, Mindset, The New Psychology of Success, Random House Pub. 2006*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Understand										
Level 2	Apply	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-
	Analyze										
Level 3	Evaluate	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Ms. Sudha Mahadevan, Career Launcher, sudha.m@careerlauncher.com	*1. Mr. Nishith Sinha, dueNorth India Academics LLP, nsinha.alexander@gmail.com*	*1. Dr. T. Mythili, SRMIST*	*2. Mrs. B. Revathi, SRMIST*
2. Mr Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	*2. Dr. Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com*	*3. Mr. P. Priyanand, SRMIST*	*4. Mrs.Kavitha Srisarann,, SRMIST*

Course Code	18LEM101T	Course Name	CONSTITUTION OF INDIA	Course Category	M	*Mandatory*	L	T	P	C
							1	0	0	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize the citizen's rights*			
CLR-2 :	*Utilize the basic citizen's fundamental rights of freedom of speech, expression, equality, religion and privacy*			
CLR-3 :	*Identify the Indian constitutional framework with union parliament, government and their functions and citizen's rights*			
CLR-4 :	*Utilize the States functionality and provisions for the betterment of the individual and society*			
CLR-5 :	*Identify the emergency provisions, the functions of election and public service commissions, identify the tax system*			
CLR-6 :	*Utilize the rights of a citizen both individual and as a society by understanding the constitutional provision and rights*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify the basic provisions in the indian constitution*	*2*	*80*	*75*	-	-	-	-	-	-	*M*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-2 :	*List the fundamental rights, rights to equality, freedom, religion, culture, education and the right against exploitation*	*2*	*75*	*70*	-	-	-	-	-	-	*M*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*Identify the fundamental duties of the Union of India, President, Vice-President, Union Ministers and Parliament functions*	*2*	*80*	*75*	-	-	-	-	-	-	*M*	*H*	*H*	*H*	*M*	*H*	-	-	-
CLO-4 :	*Identify the power of states, its legislature, Governors role and the state judiciary*	*2*	*75*	*70*	-	-	-	-	-	-	*M*	*H*	*H*	*H*	*M*	*H*	-	-	-
CLO-5 :	*List the special provisions and functionality of election commission, public service commission, individual tax and GST*	*2*	*85*	*80*	-	-	-	-	-	-	*M*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-6 :	*Build knowledge on the various aspects in the Indian Constitution, its provisions and right of a citizen and the society*	*2*	*85*	*80*	-	-	-	-	-	-	*M*	*H*	*H*	*H*	*M*	*H*	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Meaning of the constitution law and constitutionalism*	*The Directive Principles of State Policy*	*President of India (with Powers and Functions)*	*Governor of the State (with Powers and Functions)*	*Local Self Government – Constitutional Scheme in India*
	SLO-2	*Historical perspective of the Constitution of India*	*Scheme of the Fundamental Right to Equality*	*Prime Minister of India (with Powers and Functions)*	*The Chief Minister of the State (with Powers and Functions)*	*Emergency Provisions : National, President Rule, Financial Emergency*
S-2	SLO-1	*Salient features and characteristics of the Constitution of India*	*Scheme of the Fundamental Right to certain Freedom under Article 19*	*Union Judiciary (Supreme Court) Jurisdiction of the Supreme Court*	*State Judiciary (High Courts)*	*Election Commission of India (with Powers and Functions)*
	SLO-2	*Citizenship*	*Scope of the Right to Life and Personal Liberty under Article 21*	*State Government*	*Union Territories, Panchayats,*	*The Union Public Service Commission (with Powers and Functions)*
S-3	SLO-1	*Scheme of the fundamental rights*	*Union Government, Union Legislature (Parliament)*	*State Legislature, Legislative Assembly, Legislative Council*	*Municipalities, Scheduled and Tribal Areas*	*Amendment of the Constitutional Powers and Procedure*
	SLO-2	*The scheme of the Fundamental Duties and its legal status*	*Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive*	*Powers and Functions of the State Legislature, State Executive*	*Co-operative Societies*	*Income Tax, Goods and Services Tax*

Learning Resources	*1. Durgadas Basu, Introduction to the Constitution of India,Lexis- Nexis, 2015* *2. Subash C Kashyap, Our Parliament, National Books Trust, 2011*	*3. Kaushal Kumar Agarwal, India's No 1 book on Tax : Simple Language Advanced Problems: Income Tax, Kindle, 2017* *4. Vivek K R Agarwal, GST Guide for students: Making GST – Good and Simple Tax, Neelam Book House, 2017*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers				
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts		
1. Dr. Usha Kodandaraman, ABK AOTS, Chenna . drushak@gmail.com	*1 .Dr. S. P.Dhanavel, IITM, Chennai, dhanavelsp@iitm@ac.in*	*1. Dr. K. Anbazhagan, SRMIST*	*3. Dr. Sukanya Saha, SRMIST*	*5. S. Ramya, SRMIST*
2. Mr. Durga Prasad Bokka, TCS Chennai, durgaprasad@tcs.com	*2. Ms. Subashree, VIT, Chennai, subashree@vit.ac.in*	*2. Ms. Cauveri B, SRMIST*	*4. Dr. M. M.Umamaheswari, SRMIST*	

Course Code	18GNM101L	Course Name	PHYSICAL AND MENTAL HEALTH USING YOGA	Course Category	M	*Mandatory*	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Centre for Applied Research in Education*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize rich Indian heritage and knowledge for self-healing and self-protection from diseases*			
CLR-2 :	*Apply meditation for attaining happiness and balancing emotions and state of mind and body*			
CLR-3 :	*Intellectually develop oneself by identifying oneness with divine state and transform towards absolute oneness in space*			
CLR-4 :	*Socially transform into a meaningful and purposeful individual to both self and society*			
CLR-5 :	*Spiritually enlighten oneself by purifying the body, soul and have a blissful existence*			
CLR-6 :	*Achieve personal benefits of whole health and wellbeing by practicing yoga for physical, emotional and mental fitness*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify Indian heritage, culture. Identify key anatomical structures in the human body and basic exercises for the same*	*2*	*80*	*75*	-	*M*	-	-	-	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-2 :	*Apply yoga meditation practices for emotional development and wellbeing*	*2*	*75*	*70*	-	*M*	-	-	-	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*Identify educational and intellectual development methods using five sense realization and transformation*	*3*	*80*	*75*	-	*M*	-	-	-	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-4 :	*Demonstrate human values and emotions through thorough understanding about life, naturopathy and food habits*	*3*	*75*	*70*	-	*M*	-	-	-	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*Impact self and society by peaceful coexistence with self-introspection and balanced diet charts*	*3*	*85*	*80*	-	*M*	-	-	-	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-6 :	*Demonstrate yoga exercises and postures to stretch and strengthen the body and mind*	*3*	*85*	*80*	-	*M*	-	-	-	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-

		Physical Development	*Emotional Development*	*Intellectual Development*	*Social Development*	*Spiritual Development*
Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Indian Heritage & Culture, Concept of Yoga, Objectives, Science & Art of Yoga*	*Brain Functions, Bio-Magnetism, Cognitive Mind*	*Education & Intelligence Development using Yoga. Improving Intelligence*	*Introduction: Social Intelligence*	*Spiritual Connect & Yoga: Self-Realization, Self-Awareness, Self-Actualization*
	SLO-2	*Women and Yoga Practice – Classification, Modern Age, Philosophy of Life*	*Emotional Intelligences, Managing Stress and Emotions*	*Learnability through Concentration, Intelligence through learning sense organs*	*Human values, Ethics & Morality*	*Cause and Effect Realization (Karma Yoga), Harmony in Life*
S-2	SLO-1	*Practice1: Standing exercise, Surya Namaskar*	*Practice4: Surya Namaskar, Standing asanas*	*Practice7: Yoga for Youthfulness (Kayakalpah Yoga)*	*Practice10: Kayakalpha, Bhandas, Meditation (Crown)*	*Practice13: Management of Physical problems (Yoga therapy)*
	SLO-2	*Meditation (Self Realization), Relaxation*	*Meditation (Five Sense Realization), Relaxation*	*Meditation (Five Sense Realization), Relaxation*	*Self-introspection Practice (Moralization of Desire) & Relaxation*	*Meditation (Nine centre) & Relaxation*
S-3	SLO-1	*Physical Health: Body Structure, Diseases and Causes, Science of Human Body*	*Meditation for Emotional development: Eyebrow Center (Agna) Meditation*	*Theory of Intellectual Transformation: Divine state origin, absolute space,*	*Exercises for Self-Introspection: Analysis of thoughts, Moralization of desires*	*Spiritual Enlightenment*
	SLO-2	*Yoga &Youthfulness. Benefits, Comparison between other exercises and Yoga*	*Genetic Centre (Santhi) Meditation. Stress Relaxation Exercises*	*Transformation of universe, living beings, Intelligence, Knowledge, Wisdom & Peace*	*Anger Management, Eradicating worries, concerns & challenges*	*Purifying the Body (Genetic center)*
S-4	SLO-1	*Practice2: Surya Namaskar, Sitting Exercises*	*Practice5: Surya Namaskar, Sitting asanas,*	*Practice8: Kayakalpha Yoga, Pranayama*	*Practice11: Kayakalpha Yoga, Krisya Yoga*	*Practice14: Project Submission*
	SLO-2	*Meditation (Self Realization) – Relaxation*	*Meditation (Agna) & Relaxation*	*Meditation (Agna) - Relaxation*	*Yoga Mudhras, Meditation (Santhi) & Relaxation*	*Meditation, Introspection, Sublimination*
S-5	SLO-1	*Exercises: Hands, Legs, Neuro-Muscular breathing, Eye, Ears, Nostrils, kidney, brain*	*Asanas (Postures) for Body Structure: Full Body Structure Maintenance*	*Exercises: Intellectual development Brain Crown Centre (Thuriyam) Meditation*	*Therapy for Social Development: Gestures Yoga (Mudhras) – Body locks (Bhandhas)*	*Spirituality for Stress Management*

	SLO-2	*digestive tract, stomach, lungs, spine, hip, neck. Pressure points in our body*	*Standing, Sitting, Prone & Supine Posture, Benefits of asanas*	*Five Senses (Panchendriya) Meditation, Consciousness and Law of nature*	*Indian Medical System: Naturopathy, Food, Nutrition, Diet Chart for Youthfulness*	*Yoga Practices for blissful existence*
S-6	SLO-1	*Practice3: Prone & Supine posture Exercises*	*Practice6: Surya Namaskar, Prone & Supine posture Asanas*	*Practice9: Kayakalpha, Mudhras, Self-introspection Practice (Thought Analysis)*	*Practice12: Balancing Asanas,*	*Practice15: Practical Exam*
	SLO-2	*Meditation (Self Realization) – Relaxation*	*Meditation (Shanthi) & Relaxation*	*Meditation (Santhi), & Relaxation*	*Meditation (Crown) & Relaxation*	*Meditation & Relaxation*

Learning Resources	*1. Sadhguru Jaggi Vasudev, Inner Engineering – A yogi's guide to joy, 2016* *2. Shri Shri Ravi Shankar, The Art of stress-free Living, 2011* *3. Swami Ramdev Ji Yog Its Philosophy and Practice, 2008* *4. Yogiraj Vethathiri Maharishi, Yoga for Modern Age, Tenth edition, Vethathiri Publications, 2007* *5. Yogiraj Vethathiri Maharishi, Simplified Physical Exercises, Forty Second edition, Jan-2014*	*6. Vivekananda Kenthria Prkasan Trust, Yogam, 2006* *7. Swami Chetanananda, Meditation and Its Methods According to Swami Vivekananda, Jan 2001* *8. Dr. Lakshminarain Sharma, Yoga for the cure of Common Diseases, Mar 2016* *9. Swami Satyananda Saraswati, Asana Pranayama Mudra Bandha, Bihar School of Yoga, 1993* *10. Dr. Asana Andiappan, Thirumoolar's Astanga Yoga, International Yoga Academy, 2017*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-
Level 2	Apply Analyze	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-
Level 3	Evaluate Create	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-
	Total	*100 %*		*100 %*		*100 %*		*100 %*		-	

 # CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	18LEM102J	Course Name	VALUE EDUCATION	Course Category	M	*Mandatory*	L	T	P	C
							1	0	1	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English and Foreign Languages*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Connect the learners to their potential, identify their potential to create a new positive world*			
CLR-2 :	*Analyze the merits and demerits of different educational systems. Identify the different systems of education*			
CLR-3 :	*Draw attention towards the weaknesses they are susceptible to and inspire them through positive models*			
CLR-4 :	*Instill a sense of professional ethics which help them develop a safe comfortable and prosperous society*			
CLR-5 :	*Cultivate a spirit of willing accommodation in an increasingly diverse world*			
CLR-6 :	*Strengthen, enhance the spirit of positivity and facilitate positive contribution in various spheres of life*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Equipped with an awareness of their positive energy and power*	*2*	*80*	*75*
CLO-2 :	*Identify the meaning of 'education'; have a clearer and better understanding in taking education to the masses*	*2*	*75*	*70*
CLO-3 :	*Assess their weaknesses; understand risks involved and rectify them through learning from positive and negative instances*	*2*	*80*	*75*
CLO-4 :	*Realize their professional responsibilities*	*2*	*75*	*70*
CLO-5 :	*Acquire the required values in an expanding pluralistic world not be swept off their feet due to the rapid changes*	*2*	*85*	*80*
CLO-6 :	*Equip with better understanding of themselves, society they live. Identify responsibilities in creating a peaceful world*	*2*	*80*	*75*

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
L	*M*	-	-	*M*	*H*	-	*H*	*H*	*H*	-	*H*	-	-	-
M	*H*	*M*	-	*H*	*H*	*M*	*M*	*H*	*H*	-	*H*	-	-	-
M	-	-	-	*M*	*H*	*M*	*M*	*H*	*H*	-	*H*	-	-	-
H	*M*	-	-	*H*	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-
M	-	-	-	*H*	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-
M	*M*	-	-	*H*	*H*	*H*	*H*	*H*	*H*	-	*H*	-	-	-

		Visions for Youth	Youth and Education	Youth and Society	Youth as Professionals	Youth in Pluralistic Society
Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Introduction*	*Meaning and the significance of education*	*Need for social values in the present context*	*Introduction to professional values*	*Introduction to pluralistic society, forces of globalization*
	SLO-2	*Quiz*	*Brainstorming*	*Poem – "Where the mind is without fear" Write up on various instances from real life*	*Brainstorming through visual cues*	*Group Discussion*
S-2	SLO-1	*Two speeches by great personalities*	*Overview of different (traditional, modern) educational systems*	*Individual and group behavior, respect for others*	*Engineering societies in India*	*Science and technology intercultural proximity*
	SLO-2	*Oral presentations*	*Debate*	*Case study on recent happenings*	*Quiz*	*Narration of stories from various religions to illustrate the oneness of humanity*
S-3	SLO-1	*Quotes, proverbs relating to the power and potential of youth, Excerpts: Wings of Fire*	*Overview of different (traditional, modern) educational systems*	*Civic sense, bullying-substance abuse, uses of expletives*	*Challenges to be addressed by Engineers in India*	*Positive, Negative impact: religion, politics, gender, economic status, aesthetics*
	SLO-2	*Collecting proverbs highlighting the potential of youth*	*Debate*	*Case study on recent happenings*	*Case Study*	*Discussion on "To Kill a Mocking Bird"*
S-4	SLO-1	*Two news articles highlighting the initiatives for social causes by youth*	*Role of youth in education, Urban and Rural set up, dissemination*	*Hero worship, gender insensitivity, moral policing*	*Challenges in different sectors: agriculture*	*Values required to live in a global society*
	SLO-2	*Role play in a similar context*	*Student presentations*	*Case study on recent happenings*	*Case Study*	*Poster presentation on festivals of various religions*

S-5	SLO-1	*Two news articles highlighting the initiatives for social causes by youth*	*Designing and framing educational curriculum and materials*	*Positive contribution by youth in promoting social welfare*	*Challenges in different sectors: urban development, environment*	*Learning the etiquettes of various societies*
	SLO-2	*Role play in a similar context*	*Students' Presentation based on write ups*	*Short videos followed by discussions*	*Group activity (oral and written)*	*Poster presentation on festivals of various religions*
S-6	SLO-1	*One song exhibiting the positive energy of youth*	*The pressing challenges in current educational system*	*Positive contribution by youth in promoting social welfare*	*Challenges in different sectors: sustainable development, cyber security*	*Success of pluralistic society, enliven the society, religious harmony through literary*
	SLO-2	*Discussion on the song*	*Collage Design*	*Short videos followed by discussions*	*Case Study – from Newspapers*	*Writing the aspects of pluralistic society based on the text*

Learning Resources	*1. Kalam, APJ Abdul. Wings of Fire: AN Autobiography of APJ Abdul Kalam. Ed. Sangam Books Ltd., 1999* *2. "Banaras Hindu University Speech" and "To Students". The Voice of Truth. General Editor Shriman Narayan. Navajivan Publishing House. pp. 3-13 and pp. 425-30. www.mkgandhi.org* *3. Piroda, Sam. "Challenges in Science and Technology". www.nfdindia.org/loc19.htm*	*4. Thomas A Address to VTU Students by Narayana Murthy. https://www.karnataka.com/personalities/narayana-murthy/vtu-address-2006/* *5. World Economic forum. "India's top 7 challenged from skills to water scarcity*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	-	-
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	-	-
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts		
1. Dr. Usha Kodandaraman, ABK AOTS, drushsk@gmail.com	*1. Dr. S. P.Dhanavel, IIT Madras, dhanavelsp@iitmac.in*	*1. Dr .K.Anbazhagan, SRMIST*	*2. Dr. B. Cauveri, SRMIST*	
2. Mr. Durga Prasad Bokka, TCS, durgaprasad@tcs.com	*2. Ms. Subashree, VIT, Chennai, subashree@vit.ac.in*	*3. Dr. M. M.Umamaheswari, SRMIST*	*4. Dr. Sukanya Saha, SRMIST*	*5. Ms .S. Ramya, SRMIST*

Course Code	18CEO305T	Course Name	ENVIRONMENTAL IMPACT ASSESSMENT	Course Category	O	*Open Elective Courses*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	*2*	*3*
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Know the interrelationship between various activities and their impact on environment*			
CLR-2 :	*Understand Importance of EIA and its evolution*			
CLR-3 :	*Explain the concept of environmental management*			
CLR-4 :	*Learn principles and methods of environmental analysis*			
CLR-5 :	*Know how to review and comment on an environmental impact statements*			
CLR-6 :	*Understand the Application of EIA studies in various sectors through case study*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	*2*	*3*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Explainkey concepts in environmental impact assessment & Management*	*3*	*85*	*80*	*H*	-	-	-	-	-	*H*	*H*	-	-	-	-	*M*	-	-
CLO-2 :	*Understand the importance of various rules & regulation in EIA*	*2*	*85*	*75*	*H*	-	-	-	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-3 :	*Evaluate the Impact on various environments and role of stake holders in EIA*	*3*	*80*	*75*	*H*	*M*	-	*M*	-	-	*M*	-	-	-	-	-	*M*	-	-
CLO-4 :	*Apply various techniques in Impact Assessment studies*	*2*	*85*	*75*	*H*	*M*	-	-	-	-	*M*	-	-	-	-	-	*M*	-	-
CLO-5 :	*Identify most suitable tool for assessment process and make suggestions for solutions*	*2*	*85*	*80*	*H*	*M*	-	*M*	*M*	--	*M*	*M*	-	-	-	-	*M*	-	-
CLO-6 :	*Participate in a group to evaluate a project using EIA using one or more management tools*	*2*	*80*	*75*	*H*	*M*	-	-	-	-	*H*	-	*H*	-	-	-	*M*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction* *Introduction, Ecology and the environment*	*Evolution of EIA* *Evolution of EIA worldwide; Evolution of EIA in India*	*Assessment Technique* *Components of the Environment: Water- Standards pertaining to water quality*	*EIA Methodologies* *Initial Environmental Examination; Screening*	*Case Study* *Water Projects- Dams*
	SLO-2	*Discussion: Identify the characteristics of your environment*	*Discussion: Introduction to importance of Rio Convention*	*Activity & Discussion using a Case Study*	*Case Study involving screening*	
S-2	SLO-1	*Ecosystem and its characteristics*	*EIA Regulations in India* *Overview of Indian laws – Constitutional Provisions (Water, Air, Forest, Hazardous etc)*	*Components of the Environment: Air & Noise- Standards pertaining to Air & Noise quality*	*Scoping* *Analysis of alternatives*	*Case Study on Hydropower plants*
	SLO-2	*In continuation with previous class discussion in how the ecosystem in which you live gets affected by your activities*	*Discussion: Evolution of law with time*	*Activity & Discussion using a Case Study*	*Case Study in EIA*	
S-3	SLO-1	*Structure of Ecosystem; Food chains, Food webs and Tropic levels*	*Overview of- EPA 1986 & EIA Notification 2006*	*Components of the Environment: Soil- Soil quality, Landuse Criteria*	*Mitigation- Definition, options for mitigation of impact on water, air and land, water, energy, flora and fauna*	*Case Study on Nuclear Power Plants*
	SLO-2	*Identify the impact of your activities on various trophic levels of your ecosystem*	*Discussion: Various amendments of rules and regulations (MOEFCC Website)*	*Activity & Discussion using a Case Study*	*Case study Employing mitigation measures*	

Duration (hour)		9	9	9	9	9
S-4	SLO-1	*Energy and energy flows; Elemental cycles*	*CPCB and State PCBs – roles and responsibilities*	*Components of the Environment: Biosphere (Macro, Micro)- Introduction to Hazard Exposure levels for biota*	*Environmental Impact Statement- Document planning - collection and organization of relevant information*	*Case Study on Thermal Power Plants*
	SLO-2	*Choose a element cycle and how it affects the ecosystem*	*Discussion: Sethusamudram Project- Role of CPCB& SPCB and Central & State Governments*	*Activity & Discussion using a Case Study*	*Example: Case study with Documentation*	
S-5	SLO-1	*Concept of Succession;Role of succession in restoration and recovery of ecosystem*	*Environmental Risk Assessment*	*Components of the Environment: Socio-economic*	*ToR&SectoralToR*	*Case Study on Textile & Leather Industry*
	SLO-2	*Example: Restoration of an ecosystem (Mining area)*	*Discussion: risk screening/prioritization*	*Activity & Discussion using a Case Study*	*Example of ToR for various environments*	
S-6	SLO-1	*Ecosystem disturbances and their causes; natural causes and anthropogenic causes*	*Environmental management: Principles, problems and strategies; Review of political, ecological and remedial actions.*	*Components of the Environment: Cultural and Aesthetics*	*Environmental Assessment- Base line, Construction Phase, Post Construction/ Operational phase scenario*	*Case Study on Road Development Project*
	SLO-2	*Discussion: How Do Species Replace One Another in Ecological Succession?*	*Discussion With Activity: Why Environmental Management is important – using case study*	*Activity & Discussion using a Case Study*	*Case study on a project*	
S-7	SLO-1	*Ecosystem and Ecological Footprints*	*Environmental audit: Definitions and concepts, partial audit, compliance audit, Overview of methodologies and regulations.*	*Role of Public Participation in EIA*	*Impact Assessment Methodologies: Checklists- Simple, Descriptive, Scaling Checklist*	*Case Study on Transportation Projects (Airways & Seaways)*
	SLO-2	*Discussion: How Cultural Changes Have Increased Our Ecological Footprints?*	*Discussion: Introduction to ISO 14000*	*Reference EIA Notification 2006*	*Case study involving Checklist methods*	
S-8	SLO-1	*Definition and concepts of EIA, ethics and environment, EIA for civil engineers*	*Environmental management systems in local government.*	*Role of stakeholders*	*Matrix- Simple, Interaction- Leopold Matrix, Stepped matrix*	*Case Study on Solid disposal site*
	SLO-2	*Discussion: Identify the ethics that you breach in daily activities which affects the environment*	*Discussion: Expert systems (Software/ Model) used for EMS*	*Activity & Discussion using a Case Study, Role Play*	*Case study involving Matrix methods Discussion: Aldo Leopold's Environmental Ethics*	
S-9	SLO-1	*Types of EIA: Rapid; Comprehensive; Strategic; Sectoral; Regional- Rationale and scope of each type*	*Sustainable development – Definitions, Charter and Global Conventions; Future scenarios.*	*Setting the baseline*	*Network Methods Decision Tree, Expert Systems*	*Case Study on e-waste Management*
	SLO-2	*Case Study*	*Discussion on various important conventions*	*Discussion- Describe the various aspects of the environmental components of your neighborhood*	*Case study involving Network methods Introduction to various Expert system (Software/ models widely used)*	

Learning Resources	*1. L. W. Canter, Environmental Impact Assessment, 2nd Ed., McGraw-Hill, 1997.* *2. G. Burke, B. R. Singh and L. Theodore, Handbook of Environmental Management and Technology, 2nd Ed., John Wiley & Sons, 2000* ***3.** R. Therivel, John Glasson, Andrew Chadwick, Introduction to Environmental Impact Assessment (Natural and Built Environment), Routledge, 2005.*	*4. Y. Anjaneyalu, ValliManickam, Environmental Impact Assessment Methodologies, 2nd Ed., BS Publications, 2007* *5. Environnemental Management- NPTEL- https://nptel.ac.in/courses/120108004/16#* 6. *Environmental Impact Assessment- NPTEL- https://nptel.ac.in/syllabus/105103024/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*20%*	-	*20%*	-	*20%*	-	*20%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. *Dr.RajkumarDirectorHubert Envirocare Systems, Chennai, rajkumar@hecs.in*	2. *Dr. Harish Gupta, Assistant Professor*University College of Engineering*Osmania University, Hyderabad*harishgupta78@gmail.com	2. *Mr. K. Prasanna, SRMIST*

Course Code	18CEO306T	Course Name	MUNICIPAL SOLID WASTE MANAGEMENT	Course Category	O	*Open Elective Course*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*		Data Book / Codes/Standards	*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Identify the sources, types and Charecteristics of solid waste*			
CLR-2 :	*Sample and characterization of solid waste*			
CLR-3 :	*Source reduction and recycling of solid waste*			
CLR-4 :	*Waste Collection, Storage and Transport of solid waste*			
CLR-5 :	*solid waste processing techniques based on their charecteristics*			
CLR-6 :	*Solid waste disposal options and treatment*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Understand the various sources of solid waste*	*2*	*85*	*80*
CLO-2 :	*Able to identify the options for* Reduction, reuse and recycling of waste	*3*	*85*	*75*
CLO-3 :	*Knowl of collection and transport of solid waste*	*2*	*80*	*75*
CLO-4 :	*Able to know about various* waste processing technologies	*3*	*85*	*75*
CLO-5 :	*Understand the waste disposal methods and management*	*2*	*85*	*80*
CLO-6 :	*Know of basic solid waste legislations*	*2*	*80*	*75*

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*H*	*H*	*M*	*L*	-	*L*	*H*	-	-	-	-	*L*	*H*	-	-
CLO-2 :	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*H*	-	-
CLO-3 :	*H*	*H*	*M*	*M*	-	*L*	*H*	-	-	-	-	*L*	*H*	-	-
CLO-4 :	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*H*	-	-
CLO-5 :	*H*	*H*	*M*	*M*	*L*	*L*	*M*	-	-	-	-	*L*	*H*	-	-
CLO-6 :	*H*	*H*	*M*	-	-	*L*	*M*	*M*	-	-	-	-	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction and Objective of Solid waste management*	*Waste Generation and source reduction*	*Waste Collection, Storage and Transport*	*Waste Processing Techniques*	*Waste Disposal*
	SLO-2	*Sources of solid wastes*	*Waste Stream Assessment (WSA)*	*Methods of solid wastes collection*	*Purpose of Processing*	*Key Issues in Waste Disposal*
S-2	SLO-1	*Classification of Solid Wastes-Sources & Types based*	*Rationale for analysis Field investigation*	*Analysis of collection system*	*Mechanical Volume and Size Reduction*	*Disposal Options and Selection Criteria*
	SLO-2	*Charectistics of waste- Physical, Chemical, Biological.*	*Onsite seggregation and resousrce recovery*	*Analysis of collection system*	*Volume reduction or compaction*	*Landfill and its essential components*
S-3	SLO-1	*Charectistics of waste- Physical, Chemical, Biological.*	*Waste Generation and Composition*	*Collection Components*	*Size reduction or shredding*	*Types and methods of Landfill*
	SLO-2	*Charectistics of waste- Problem solving*	*Waste Generation and Composition*	*Storage: Containers / Collection Vehicles*	*Component Separation*	*Liner and its types*
S-4	SLO-1	*Salient features of Indian Legislations on management and handling of municipal solid wastes*	*Factors causing variation*	*Storage: Containers/Collection Vehicles*	*Air separation*	*Materials used for liners*
	SLO-2	*Public health effect - Environmental effect*	*Materials used for onsite storage containers*	*Collection crew safety and monitoring*	*Magnetic separation*	*Daily cover and their objectives, materials used*

Duration (hour)		9	9	9	9	9
S-5	SLO-1	*methods of sampling and characterization*	*Source Reduction: Basics*	*Tutorial5: Identify the suitable collection sytstem for urban areas*	*Screening*	*Leachate Composition and properties*
	SLO-2	*methods of sampling and characterization*	*Purpose and Implementation*	*Collection Operation*	*Other separation techniques*	*Leachate Formation-migration and control*
S-6	SLO-1	*Tutorial 1: Identify the effects of solid waste.*	*Monitoring and Evaluation*	*Movement of collection crew*	*Composting and their factors*	*Leachate treatment*
	SLO-2	*Tutorial 2: Case Study: Status of Waste Generation in Bangalore*	*Storage and collection of recyclables*	*Collection vehicle routing*	*Benefits, Processes, types,Technologies*	*Landfill gas managment system*
S-7	SLO-1	*Public awarness and practices in waste managment*	*Processing equipments for recycling*	*Transfer station and their goals*	*Biogasification-Anaerobic processing*	*Gas monitoring, treatment methods*
	SLO-2	*Factors affecting SWM system*	*Material recovery facilities (MRF's)*	*Types of Transfer station*	*Composting and Biogasification: EnvironmentalEffects*	*Environmental Effects of Landfill*
S-8	SLO-1	*Progress of MSW Management in INDIA*	*Significance of Recycling*	*Capacity and Viability*	*Incineration , Pyrolysis and Energy recovery*	*Landfill remedeation and rehabitation of open dumps*
	SLO-2	*Progress of MSW Management in INDIA*	*Advantages and disadvantages in resource recovery*	*Waste Collection System Design*	*Drying and Dewatering*	*Integrated Waste Management (IWM)*
S-9	SLO-1	*Solid waste Management System*	*Tutorial 3: Source Reduction and Recycling in Bangalore:*	*Record Keeping, Control, Inventory and Monitoring*	*Drying and Dewatering*	*Public Education and Involvement*
	SLO-2	*Solid waste Management System*	*Tutorial 4: Problems solving in recycling*	*Implementing Collection and Transfer System*	*Tutorial 6: Identify suitable method of treatment for various types of solid waste*	Tutorial 7:Waste Disposal: A Case Study of Bangalore

Learning Resources	1. *GeorgeTchobanoglous, Hilary Theisen, Samuel Vigil, Integrated Solid Waste Management, McGraw Hill,1993* 2. *Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental* 3. *Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001.*	4. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2000. 5. *NPTEL Course-Municipal solid waste mangment. https://nptel.ac.in/courses/120108005/* 6. *NPTEL Course-Solid and HAzardous waste mangmenthttps://nptel.ac.in/courses/105106056/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai, rajkumar@hecs.in	*1. Dr. E. S. M Suresh,NITTT TaramaniChennai esmsuresh@gmail.com*	*1. Mr. D. Justus Reymond, SRMIST*
2. Mr. A. Abdul Rasheed, CMWSS Board, juruterarasheed@gmail.com	*2. Dr. G. Dhinagaran, Asst. Professor, CES, Anna University*, twinsdina@gmail.com	*2. Mr. K.Prasanna, SRMIST*

Course Code	18CEO307T	Course Name	DISASTER MITIGATION AND MANAGEMENT	Course Category	O	Open Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understanding basic concepts of disaster and hazards of India.
CLR-2 :	Studying the various natural disasters.
CLR-3 :	Studying the various manmade disasters.
CLR-4 :	Understanding he disaster management principles.
CLR-5 :	Studying the modern techniques used in disaster mitigation and management.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Understand basic concepts of disaster and hazards of India.	3	85	80
CLO-2 :	Acquire Knowledge on the various natural disasters.	3	90	85
CLO-3 :	Acquire Knowledge the various manmade disasters.	2	85	80
CLO-4 :	Understand the disaster management principles.	2	85	80
CLO-5 :	Appreciate the modern techniques used in disaster mitigation and management.	3	80	70

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	H	-	-	M	-	-	-	-	-	-	-	H	H	-
H	H	-	-	H	-	-	-	-	-	-	-	H	H	-
H	H	-	-	H	-	-	-	-	-	-	-	H	H	-
H	H	-	-	M	-	-	-	-	-	-	-	H	H	-
H	H	-	-	H	-	-	-	-	-	-	-	H	H	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction - Definition	Natural Disasters	Anthropogenic disaster	Disaster management	Disaster Mitigation
	SLO-2	Nature, Importance of Hazard,	Causes and nature of natural disaster	Man Made Disasters	Components of DM	Mitigation Planning
S-2	SLO-1	Risk,	Disaster types	Nuclear disasters	Pre- disaster stage (preparedness) -	Empowerment and community-based mitigation.
	SLO-2	Vulnerability and Disaster	Effects of disaster	Radiation Damage	Preparing hazard zonation maps,	Response plan
S-3	SLO-1	- Dimensions	Flood Disaster. causes and effect	Chemical disasters and Products	Predictability/ forecasting	Functional plan
	SLO-2	Scope of Disaster	Drought-causes and effect	Reactions and solutions	Warning system	Public health and Emergency services
S-4	SLO-1	Characters of Disaster	Cyclone- Origin and effect	Biological disasters-Sources and agents	Preparing disaster preparedness plan	Meteorological observatory
	SLO-2	Phases of disaster management	Earthquakes and its impact	Impact of biological disasters	Land use zoning	Seismological observatory
S-5	SLO-1	Effects	Landslides- Causes and Impact	Building fire–Impact and Mitigation	Preparedness through Information and education.	Hydrology Laboratory
	SLO-2	Dynamics of Disaster	Avalanches,	Coal fire- Causes and Remedies	Emergency Stage	Industrial Safety inspectorate.
S-6	SLO-1	India's Key Hazards Management	Volcanic eruptions- Impact- Pollution	Forest fire- Causes and control measures	Rescue training for search & operation -	Technology in Disaster Management -
	SLO-2	Vulnerabilities	Heat and cold waves	Oil fire	Immediate relief	Emergency Management Systems (EMS)
S-7	SLO-1	National disaster management framework	Climatic change	Air pollution	Assessment surveys	Remote Sensing in Disaster Management
	SLO-2	Disaster Management Cycle	global warming	Causes and effect	Post Disaster stage	GIS inDisaster Management
S-8	SLO-1	NDMA	Causes and Control	Water pollution- sources	Rehabilitation	Hazard specific Mitigation Plan
	SLO-2	Disaster response	Sea level rise	Effect of water pollution	Social Aspects	Hazard specific Mitigation Plan
S-9	SLO-1	Disaster management policy and plans	ozone depletion	Deforestation	Economic Aspects	Knowledge Dissemination
	SLO-2	Challenges in disaster response	Impact studies	Industrial waste water pollution	Environmental Aspects	Capacity building

Learning Resources	1. *M.M Sulphey, Disaster Management , PHI Learning publishers, India 2016* 2. *Harsh K Gupta, Disaster management, University Press Publications India ,2012* 3. *Michael J. Fagel, Principles of Emergency Management: Hazard Specific Issues and Mitigation Strategies* 4. *CRC Press; 2011* 5. *ASingh.R.B, "Natural Hazards and Disaster Management: Vulnerability and Mitigation", Rawat* 6. *Publications, 2006.*	7. *Gupta.M.C, "Manuals on Natural Disaster management in India", National Centre for Disaster Management,IIPA, New Delhi, 2001..* 8. *NPTEL Course –Natural hazards, https://nptel.ac.in/courses/105104183/7* 9. *VenuGopal Rao.K, "Geoinformatics for Disaster Management", Manglam Publishers and Distributors.* 10. *8..NPTEL Course, Urban risk and Disaster management, https://nptel.ac.in/courses/124107007/35*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. P Murugan, Group Head, IRS-PMSG, ISRO Bangalore, muru@ursc.gov.in	*1. Dr. DipakSamal, CEPT University, Ahmedabad-380009 samaldipak@gmail.com*	*1. Dr. R. Sivakumar, SRMIST*
2. Mr. Pavesh Iyer, Intergraph, Chennai. Previsn.Iyer@intergraph.com	*2. Dr. R. Jayangondaperumal, Wadia Institute of Geology, Dehradun,ramperu.jayan@gmail.com*	*2. Mr. V. Satya Ramesh Potti, SRMIST*

Course Code	18CEO405T	Course Name	WATER POLLUTION AND ITS MANAGEMENT	Course Category	O	Open Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Create insights to the source and type of water pollution			
CLR-2 :	Analyse the charecteristics of domestic and industrial water pollution			
CLR-3 :	Utilize resource recovered from the waste water			
CLR-4 :	Concept of treating polluted water.			
CLR-5 :	Identify the various methods to control the water pollution and regulatory bodies			
CLR-6 :	Sustainable practice for effective water management.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Understand the various sources of water pollution	2	85	80	H	H	M	L	-	L	H	-	-	-	-	L	H	-	-
CLO-2 :	Knowledge of various charecteristics presented in polluted water.	3	85	75	H	H	H	H	-	-	H	-	-	-	-	-	H	-	-
CLO-3 :	Apply the concept of resource recovered from the polluted water.	2	80	75	H	H	M	M	-	L	H	-	-	-	-	L	H	-	-
CLO-4 :	Able to understand the treatment of polluted water.	3	85	75	H	H	H	H	-	-	H	-	-	-	-	-	H	-	-
CLO-5 :	Knowledge of Water Act 1974 and regulatory bodies to control of Water Pollution	2	85	80	H	H	M	M	L	L	M	-	-	-	-	L	H	-	-
CLO-6 :	Analyze the environmental impact of water pollution	2	80	75	H	H	M	-	-	L	M	M	-	-	-	-	H	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to water pollution.	Charecteristics of water and wastewater.	Mitigation Measures for Water pollution Contamination due to industries.	Water Pollution Regulations	Sustainable water managment techniques
	SLO-2	Sources and types of water pollution.	Physical characteristics-Colour, odour, Turbidity, Temperature, Specific conductivity	Treatment of Industrial wastewater	Administrative regulation under recent legislations in water pollution control.	Rain water Harvesting.
S-2	SLO-1	Point source pollution and Non point source pollution.	Chemical Characterictics- Organic and Inorganic.	Guidelines and protocol for treating Industrial wastewater.	Water (Prevention & control of pollution) Act 1974.	Classification of rainwater harvesting
	SLO-2	Types of pollutants.	Biological Charecteristics and its significance.	Pollution characteristiscs of certain typical industries.	Water (Prevention & control of pollution) Rules 1975- Water (Prevention &control of pollution) Cess Act 1977.	Microlevel harvesting, macrolevel harvesting and other methods
S-3	SLO-1	Adverse effects of pollutnats.	Analysis of water pollution and their testing procedures.	Thermal pollution and its adverse effects.	Role of pollution control board.	Roof top harvesting and their benefits
	SLO-2	Principles of pollution assessment.	Water Quality standards-BIS	Role of regulatory bodiesin Protection of Water bodies-Control Measures.	Powers given to boards	Role of Regulatory bodies
S-4	SLO-1	Terms and definitions in wastewater.	Discharge of Effluent and their standards	Discharge Standards for Rivers and Streams	Irrigational approach in waste conservation	Role of local bodies- TWAD Board – CMWSSB.
	SLO-2	Transport of pollutants.	Water borne diseases.	Self purification of streams.	Legal action against defualters.	Case Studies related to Effective Water Management.
S-5	SLO-1	Causes of Water pollution.	Impact of water related issues on animals.	Role of stakeholders.	Managmentstratergy used for water conservation	Water crisis and their effects

Duration (hour)		9	9	9	9	9
	SLO-2	*Hydraulic flow of water pollution.*	*Ground water quality.*	*Water quality monitoring and its purpose*	*Industrial approach in water conservation*	*Problems faced in water crisis*
S-6	SLO-1	*Sampling procedure.*	*Impact on Effluent in ground water quality.*	*Monitoring activities and its stratregy*	*Awarness of domestic usage for conservation of water*	*Zero water day - Awareness*
	SLO-2	*Methods of sampling and storage*	*Effects of ground water pollution*	*Types of monitoring*	*Groundwater management.*	*Awarnessprogramme for water management and its sustainable development*
S-7	SLO-1	*Effects of water pollution*	*Sampling methods of ground water pollution*	*Steps involved in water quality monitoring*	*Public participation in water managment*	*Importance of World water day andWorld Environment day.*
	SLO-2	*Eutrophication and their process*	*Legal regulatory aspects of groundwatercontamination*	*Parameters and frequency of monitoring*	*Environmental indicies and its types*	*Vulnerability of improper water management*
S-8	SLO-1	*Public awarness and practices in water pollution.*	*IndustrialPartcipation with regulatory boards.*	*Graphical reperesentation of water quality*	*Water quality index and its types*	*Case study on adverse effects of watercrisis*
	SLO-2	*Industries and their role in water pollution*	*Water used in different industries*	*Softwares used in water quality modelling.*	*Assesment of water quality index*	*Sustainable development*
S-9	SLO-1	*Tutorials 1: Identify the various source of water pollution*	*Tutorials 3: Analyse the sample of polluted water.*	*Tutorials 5: Mention the various mitigation measures in Industries*	*Tutorials 7: Case study on Industrial pollution in water bodies*	*Tutorials 9: Compare potential rain water harvesting method*
	SLO-2	*Tutorials 2: NGO participation in creating awarness of water pollution*	*Tutorials 4: Compare the various industrial effluent discharge standards*	*Tutorials 6: Case study of water contamiation and its mitigation*	*Tutorials 8: Identify effective water management technique.*	*Tutorials10: Effective water management pactices.*

Learning Resources	
1. *Fair.G.M, "Water and Waste water engineering Vol.I& II" .John Wiley and sons, Newyork. 2010.* 2. *Metcalf & Eddy, "Wastewater engineering, Treatment and Reuse", Tata MacGrawhill publications, 2008.* 3. CPHEEO, ""Manual on Sewerage & Sewage Treatment", Ministry of Housing and Urban Affairs,Government of India, New Delhi, 2009.	4. P. K. Goel, Water Pollution: Causes, effects and Control. New Age International, 2006. 5. *NPTEL Course: Water, Society and Sustainability. -https://onlinecourses-archive.nptel.ac.in/noc18_hs36* 6. *NPTEL Course: Wastewater Treatment & Recycling. https://onlinecourses-archive.nptel.ac.in/noc18_ce26*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai, rajkumar@hecs.in	*1. Dr. E. S. M Suresh,NITTTR, TaramaniChennai. esmsuresh@gmail.com*	*1. Mr. K.Prasanna, SRMIST*
2. Mr. A. Abdul Rasheed, CMWSS Board, juruterarasheed@gmail.com	*2. Dr. G. Dhinagaran, Asst. Professor, CES, Anna University, twinsdina@gmail.com*	*2. Mr. S.Dhanasekar, SRMIST*

Course Code	18CEO406T	Course Name	GLOBAL WARMING AND CLIMATE CHANGE	Course Category	O	Open Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	To know about earth systems	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	To know basics of climate parameters and climate change causing elements			
CLR-3 :	Create awareness about global warming			
CLR-4 :	Address to climate change impact to various sectors			
CLR-5 :	Address to different mitigation measures against global warming and their protocol			
CLR-6 :	Create awareness to use of renewable resource to reduce global warming			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	To understand earth system importance	2	85	80
CLO-2 :	Understand climate parameters and their impact due to human activates	3	85	75
CLO-3 :	Ability to explain climate change impact in various sector	3	85	75
CLO-4 :	Understand different protocol related to climate change	2	85	80
CLO-5 :	Understand reason behind global warming	2	80	75
CLO-6 :	Ability to get projects related to mitigation measures of climate change	3	85	75

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
H	H	-	-	-	-	-	-	-	-	-	-	H	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to earth system- Hydrosphere, lithosphere, cryosphere, atmosphere and biosphere	Climatology	Climate change impact in different sectors	Climate change mitigations and adaptations	Climate change negotiations
	SLO-2	Earth system-hydrological cycle and carbon cycle	Paleoclimatology	Agriculture	Climate change Organization and programmes	Mitigation measures
S-2	SLO-1	Earth system- cryosphere and biosphere	Climatology proxies	Forestry	IPCC-Intergovernmental Panel on Climate Change and assessment report highlights	Use of renewable resources- solar energy
	SLO-2	Importance of earth system and climate	Indian climate system and their classification	Fishery	IPCC Assessment Report-1	Wind energy
S-3	SLO-1	Atmosphere and its composition	Role of land and ocean to regulate climate	Socio economic impact – tourism,	IPCC Assessment Report-2	Tidal energy
	SLO-2	different strata of atmosphere and temperature profile	Role of ice and wind to regulate climate	industries and business	IPCC Assessment Report-3	Hydrothermal and geothermal energy
S-4	SLO-1	Weather and Climate	Causes of climate change Milankovitch theory (change Natural cause)	Acid rain and human health impact	IPCC Assessment Report-4	Clean Technology, biodiesel, compost, biodegradable plastics
	SLO-2	Climate parameter- temperature, atmospheric pressure	Milankovitch theory and climate	Sea surface temperature increases and aquatic organisms impact	IPCC Assessment Report-5	Concept of sustainable development
S-5	SLO-1	Atmospheric humidity and rainfall	Human induced climate change (anthropogenic causes)	Weather and climate parameters measuring instruments	UNEP - United Nations Environment Programme	Concept of Carbon sequestration

Duration (hour)		9	9	9	9	9
	SLO-2	*Wind circulation*	*Global radiance balance of climate system*	*thermometer, hygrometer or psychomotor*	WMO - *World Meteorological Organization*	*Terrestrial sequestration*
S-6	SLO-1	*Ocean circulation*	*Global temperature changes*	*Rain gauge and tide gauge,*	UNFCCC - *United Nations Framework Convention on Climate Change*	*Ocean sequestration*
	SLO-2	*Atmospheric stability and lapse rate*	*Climate change impacts – Ice melting in global level and albedo*	*barometer and anemometer*	UNDP - *United Nations Development Program*	*Adaptation measures*
S-7	SLO-1	*Atmospheric stability continuation*	*Impact and risk of Irreversible changes*	*Ice probes and sediment corer*	*Need for international protocols of climate change*	*Green building technology*
	SLO-2	*Pollutant dispersion*	*Sea level rise and their impact*	*Climate feed back*	*Kyoto protocol*	*Landscaping restoration and plantation*
S-8	SLO-1	*Introduction to greenhouse gases and global warming*	*Ocean acidification and their impact*	*Water vapor feed back*	*Climate change and carbon credit*	*Mitigations and adaptation in India*
	SLO-2	*Photo chemical smog*	*Precipitation pattern change*	*Ice albedo feed back*	*Clean Development Mechanism (CDM)*	*Prevent and precaution measures (health issues, environmental damages)*
S-9	SLO-1	*Ozone depletion*	*Flood and drought*	*Vulnerability assessment*	*UNFCCC and India*	*Energy policies for a cool future*
	SLO-2	*El Nino and their impact*	*Frequent floods in India reason*	*Case study on vulnerability assessment – flood, drought and heat waves*	*Montreal protocol*	*Energy Audit.*

Learning Resources	1. *Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Private limited 2007.* 2. *Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.* 3. *Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.* 4. *Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge university press, 2003.* 5. *NPTEL Course- Atmospheric Science https://nptel.ac.in/courses/119106008*	6. *NPTEL Course – Environmental Air Pollution:https://nptel.ac.in/courses/105102089* 7. *Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 2008: Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp.* 8. *NPTEL course – Wild Life Conservation:https://nptel.ac.in/courses/102104068*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *Mr. SuyashMisra,* Technical Discipline Leader,Arcadis Consulting India Private Limited *Bangalore,* suyash.misra@gmail.com	1. *Dr. Vivekanand, MNIT Jaipur*vivekanand.cee@mnit.ac.in	1. *Dr. R. Nagalakshmi, SRMIST*
2. *Dr.RajkumarDirectorHubert Envirocare Systems, Chennai, rajkumar@hecs.in*	2. *Dr. Harish Gupta,* University College of Engineering *Osmania University, Hyderabad,* harishgupta78@gmail.com	2. *Mr. R. Vinothkumar, SRMIST*

Course Code	18CEO407T	Course Name	APPLICATIONS OF REMOTE SENSING AND GIS	Course Category	O	*Open Elective Course*	L	T	P	C
							3	0	0	3

Pre-requisite Courses		Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*		Data Book / Codes/Standards	*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Studying the basic principles of remote sensing*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	*Studying and understandingvarious remote sensing methods*			
CLR-3 :	*Understanding GIS anddata capturing*			
CLR-4 :	*Studying data analysis in GIS*			
CLR-5 :	*Application of RS and GIS in various fields*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Study the basic principles of remote sensing*	*3*	*90*	*85*
CLO-2 :	*Study and understand various remote sensing methods*	*3*	*90*	*85*
CLO-3 :	*Understand GIS and components*	*2*	*85*	*80*
CLO-4 :	*Study the data capturing and data analysis in GIS*	*2*	*85*	*80*
CLO-5 :	*Apply RS and GIS in various field*	*3*	*85*	*80*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	*H*	-	-	*M*	-	*M*	-	-	-	-	-	*H*	*H*	-
H	*H*	-	-	*H*	-	*H*	-	-	-	-	-	*H*	*H*	-
H	*H*	-	-	*H*	-	*H*	-	-	-	-	-	*H*	*H*	-
H	*H*	-	-	*M*	-	*M*	-	-	-	-	-	*H*	*H*	-
H	*H*	-	-	*H*	-	*H*	-	-	-	-	-	*H*	*H*	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction of Remote sensing*	*Visual Image interpretation*	*Introduction to GIS*	*Spatial data analysis*	*Remote sensing Applications*
	SLO-2	*EMR and its Characters*	*Elements of Image interpretation*	*Elements of GIS*	*Non Spatial Data analysis*	*GIS Applications*
S-2	SLO-1	*Electromagnetic Radiation interaction with Atmosphere*	*Digital Image formats*	*cartography*	*Spatial interpolation*	*RS and GIS Integration*
	SLO-2	*Electromagnetic Radiation interaction with Earthsurface features*	*Raster data format*	*Maps and types*	*Data retrieval – Reclassification Techniques*	*RS and GIS in Environmental studies*
S-3	SLO-1	*Remote Sensing Systems*	*Image distortion and rectification*	*Co Ordinate system*	*Buffer analysis*	*RS and GIS in geology*
	SLO-2	*Platforms and sensors*	*Atmospheric correction*	*Projection*	*Vector and Topological Overlay analysis*	*RS and GIS in Urban planning*
S-4	SLO-1	*Scanning mechanisms*	*Radiometric correction*	*Datum*	*Raster overlay analysis*	*RS and GIS in smart city planning*
	SLO-2	*Optical and Thermal scanners*	*Geometric correction*	*GIS - data Types*	*Measurement -*	*RS and GIS in Flood disaster studies*
S-5	SLO-1	*Microwave remote sensing*	*Image enhancement*	*Spatial and Non spatial data*	*Spatial and Non spatial Query*	*RS and GIS in landslide studies*
	SLO-2	*Lidar remote sensing*	*Contrast enhancement*	*Data input - Methods*	*Expert System*	*RS and GIS in Geological studies*
S-6	SLO-1	*LANDSAT series SPOT Series*	*Image classification*	*Digitization*	*Digital Elevation model*	*RS and GIS in Soil studies*
	SLO-2	*Indian Remote Sensing Satellites*	*Supervised classification*	*Errors in Digitization*	*Generation- parameters*	*RS and GIS in Rural Planning*
S-7	SLO-1	*Metrological Satellites*	*Unsupervised classification*	*Data output - Methods*	*Modelling surface*	*RS and GIS in Smart transport Planning*
	SLO-2	*High resolution satellites*	*Pattern recognition*	*Software Modules*	*DEM application*	*RS and GIS in health application*
S-8	SLO-1	*Resolution*	*Filtering techniques*	*Vector data Structure*	*Digital Terrain Model and Visualisation*	*RS and GIS in Agriculture studies*
	SLO-2	*Types of resolutions*	*Change detection*	*Topology*	*TIN-Generation*	*RS and GIS in Forest Mapping*
S-9	SLO-1	*Merits*	*Image merging*	*Raster data Structure*	*Cost-Path analysis*	*RS and GIS in water resources studies*
	SLO-2	*Multi and Hyperspectral Remote sensing*	*Advantages*	*Merits and Demerits*	*DEM and DTM –Merits and Demerits*	*RS and GIS in Environmental studies*

Learning Resources	1. *Patrick McHaffie, Sungsoon Hwang, Cassie FollettGIS: An Introduction to Mapping Technologies, CRC* 2. *Press , Taylor & Francis Group, Boca Raton FL 2019* 3. *M. Anji Reddy, Textbook of Remote Sensing and Geographical Information systems, BS Publications* 4. *A.M. Chandra and S.K. Ghosh. Remote Sensing and Geographical Information system .Narosa Publishing* 5. *House, New Delhi. 2006* 6. *Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman, "RemoteSensing and Image Interpretation", John Wiley & Sons, 2008.*	7. *John R. Jensen,,Introductory Digital Image Processing: "A remote sensing perspective", Prentice Hall* 8. *NPTEL Course — Introduction to GIS https://nptel.ac.in/courses/105102015/:* 9. *Floyd F. Sabins, Jr: "Remote Sensing Principles and Interpretation", Freeman and Co., San* 10. *Franscisco, 2007* 11. *NPTEL Course, Introduction to remote sensing , https://nptel.ac.in/courses/105108077/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Dr.Manthiramoorthy, SAC, ISRO Ahmedabad ,smmoorthi@sac.isro.gov.in	*1. Dr. C. Jeganathan, Birla Institute of Technology, Mesra, jeganathanc@bitmesra.ac.in*	*1. Dr. R. Sivakumar, SRMIST*
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ACADEMIC CURRICULA

Professional Core Courses

CIVIL ENGINEERING

Regulations - 2018

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Kancheepuram, Tamil Nadu, India

Course Code	18CEC201T	Course Name	ENGINEERING GEOLOGY	Course Category	C	Professional Core	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Identify the various geological processes			
CLR-2 :	Analyze the Minerals of Earth crust			
CLR-3 :	Analyze about the Rocks of the Earth Crust			
CLR-4 :	Interpret the various geological structures			
CLR-5 :	Utilize the geological investigations Techniques			
CLR-6 :	Identify Geological considerations for civil engineering projects			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Identify the geological agencies and their actions	2	85	80	H	-	-	-	-	-	M	-	L	-	-	H	H	-	-
CLO-2 :	Identify the physical property of rock forming minerals	2	85	75	H	-	-	-	-	-	M	-	L	-	-	H	H	-	-
CLO-3 :	Classify, Structure, Identify texture and the distribution of various types rocks	2	80	75	H	-	-	-	-	-	H	-	L	-	-	H	H	-	-
CLO-4 :	Interpret the various geological structure	2	85	80	H	-	-	-	-	-	H	-	L	-	-	H	H	-	-
CLO-5 :	Analyze the investigation techniques	3	85	75	H	-	H	M	-	-	H	-	M	-	-	H	H	-	-
CLO-6 :	Analyze the primary measures for civil Engineering projects	3	80	75	H	H	H	H	-	-	H	-	M	-	-	H	H	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Applications of Geology in Civil Engineering	Physical properties of minerals and its identification methods	Rocks of the earth crust	Discontinuities in the rock &Structure of the Rock	Geology for Engineering Projects - Topography and types of land forms, reading of Toposheet
	SLO-2	Internal structure of Earth	chemical and optical properties of minerals and its role in Alkalinity reactivity	Types of rocks and kinds of building materials	Contour and drainage map analysis to determine topography, slope of the ground	Geological mapping methods of a construction site
S-2	SLO-1	Endogenous process- Earthquake & Plate Tectonics	Physical properties of quartz group minerals and its optical properties- strained quartz analysis –cement bonding effects	Igneous Rocks- Types, composition, alteration process	Attitude of rocks- DIP & Strike	Geological mapping of subsurface topography
	SLO-2	Physical weathering-process, merits and demerits of weathering zones in project area	Physical properties of Feldspar group minerals and optical properties. Chemical reaction of feldspars and formation of clay	Igneous Rocks- structure, veins, caves,	Geological Structures – Folds	Geophysical Investigations –Self potential method
S-3	SLO-1	Chemical and biological Weathering process, merits and demerits of weathering zones in project area	Mica group of minerals, types and deleterious minerals	Engineering Properties, of the Igneous rocks – Granite, Diorite, dolerite, Basalt, Biotite granite, felsic granite	Fold Classification	Geophysical Investigations –equipotential and potential drop method
	SLO-2	Products of weathering, Weathering grade analysis- with strength of the rocks	Mafic minerals, types and deleterious minerals, Identification of minerals Quartz minerals-strained quartz analysis –cement bonding effects	Igneous rocks – composition and structure; response to rock strength Engineering properties of Igneous rocks as foundation rock and aggregates	Fold signification in geological investigations, Fold axis and determination of orientation of rock	Seismic methods-Reading seismic lines and deciphering subsurface stratal geology

S-4	SLO-1	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*
	SLO-2					
S-5	SLO-1	*Groundwater- origin, factors of formation, types, water table, Groundwater quality*	*Pyroxene group of Minerals*	*Sedimentary Rocks- Types*	*Geological Structures – Fault*	*GPR technology and subsurface mapping Gravitational techniques*
	SLO-2	*Rainwater harvesting methods, Drainage patterns*	*Amphibole group of Minerals*	*Conglomerate, breccia, Sand, sandstone, composition, quality analysis, alteration signatures*	*Fault Classification*	*Remote Sensing Techniques for civil engineering*
S-6	SLO-1	*Exploration method of Groundwater- Electrical resistivity survey technique*	*Gem group of Minerals*	*Limestone, types, composition, properties, solution reactivity and cave formation*	*Fault Classification*	*Applications of satellite mapping methods*
	SLO-2	*Geomorphic landforms performed at- Desert, lands (wind) merits and demerits for civil engineering. projects*	*Properties of Gypsum*	*Clay minerals types formation and Engineering properties*	*Geological Structures – Joints*	*Geological Considerations for Dam*
S-7	SLO-1	*Geomorphic landforms performed by sea erosion, merits and demerits for civil engineering. projects*	*Physical Properties of Calcite*	*Engineering Properties of the Sedimentary rocks-, Breccia and Conglomerate, sandstone and limestone*	*Joint Classification*	*Geological Considerations for Dam*
	SLO-2	*Geomorphic landforms performed at ice covered lands merits and demerits for civil engineering. projects*	*Physical Properties of Gypsum,mica*	*Metamorphic Rock types, description of gneiss, quartzite, marble, slate, schist, phyllite*	*Joint Classification*	*Geological Considerations for Dam*
S-8	SLO-1	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*
	SLO-2					
S-9	SLO-1	*Geomorphic landforms performed at River Erosion its merits and demerits for civil engineering. projects*	*Clay minerals and, types*	*Metamorphic rocks Textures and structures,*	*Engineering Considerations of Fold*	*Geological Considerations for Reservoirs*
	SLO-2	*Landforms performed at River deposition, its merits and demerits for civil engineering. projects*	*Clay properties as lining and filter materials*	*Engineering properties of metamorphic rocks*	*Engineering Considerations of Fold*	*Geological Considerations for Reservoirs*
S-10	SLO-1	*Coastal erosional and depositional land forms*	*Engineering properties of Clay*	*Preparation of Fence diagram and delineation of subsurface rock layers*	*Engineering Considerations of Fault*	*Geological Considerations for hard and soft Tunnels*
	SLO-2	*Sea water dynamics and Coastal protection structures*	*Coal deposits and mines in India*	*Litho core/Borehole rock analysis*	*Engineering Considerations of Fault*	*Geological Considerations for Tunnels and Road Cuts*
S-11	SLO-1	*Landslides, causes for landslides, factors.*	*Coal properties*	*Rock litho core analysis,*	*Engineering Considerations of Joint*	*Demonstration of Clinometer, Brunton, GPS, GPR*
	SLO-2	*Types of landslides, landslide mitigation structures*	*Petroleum deposits of India*	*Determination of rock strength*	*Engineering Considerations of Joint*	*Identification of maps, type of soils,*
S-12	SLO-1	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*
	SLO-2					

Learning Resources	1. *Garg .S.K, Physical and Engineering Geology, Khanna Publication, New Delhi, 1999* 2. *Parbin Singh, Engineering and General Geology, Katson Publication House, 2010* 3. *Maruthesha Reddy M.T, Engineering Geology Practical, New Age International Pvt Ltd, 2003* 4. *Legeet, Geology and Engineering, McGraw Hill Book Company, 1998*	5. *Blyth, Geology for Engineers, ELBS, 1995* 6. *NPTEL: Earth Sciences for Civil Engineering Part I. https://onlinecourses.nptel.ac.in/noc18_ce12/preview* 7. *NPTEL: Subsurface exploration :importance and techniques. https://onlinecourses.nptel.ac.in/noc19_ce10/preview*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Dr. Sarunjith K J, National Centre for Sustainable Coastal Management, sarunjith@ncscm.res.in	*Dr. R. Nagendra, Anna University, geonag@gmail.com*	*Dr. R Annadurai, SRMIST*	*Dr. Sachikanta Nanda, SRMIST*
2. Dr. Nagasundaram M, Geological Survey of India, nagasundaram.m@gsi.gov.in	*Dr. S. G. D. Shreedhar, University of Madras, sgd.sri@unom.ac.in*	*Dr. Aparna S Bhaskar, SRMIST*	

Course Code	18CEC202T	Course Name	FLUID MECHANICS	Course Category	C	Professional Core	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	18CEC202L	Progressive Courses	18CEC206T
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Utilize the various properties of fluids	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Analyze hydrostatics, buoyancy; stability of floating and submerged bodies			
CLR-3 :	Utilize pressure measuring devices			
CLR-4 :	Analyze concepts of fluid kinematics			
CLR-5 :	Apply fluid dynamics for practical applications			
CLR-6 :	Utilize the concepts of flow through pipes in real time applications			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Identify the various properties of fluid	2	85	80
CLO-2 :	Analyze hydrostatic pressure force	3	85	75
CLO-3 :	Apply hydrostatic laws in various pressure measuring devices	3	85	75
CLO-4 :	Identify the importance of fluid kinematics	2	85	80
CLO-5 :	Identify the applications of fluid dynamics	2	80	75
CLO-6 :	Analyze laminar and turbulent flow in pipes	3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
H	H	-	M	-	-	-	-	-	-	-	-	H	-	-
H	H	-	M	-	-	-	-	-	-	-	-	H	-	-
H	H	-	M	-	-	-	-	-	-	-	-	H	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Fluid properties Importance, application of fluid mechanics	U tube differential manometer, upright and inverted differential manometer	Stream line, path line, streak line and stream tube	Momentum equation	Pipes in series and parallel
	SLO-2	Distinction between fluid and solid, mass density, specific weight, specific gravity	Mechanical gauges	Velocity potential function	Force exerted by a flowing fluid on a pipe bend	Equivalent pipes
S-2	SLO-1	Newton's law of viscosity, kinematic and dynamic viscosity	Fluid statics: Hydrostatic pressure force: horizontal and vertical surfaces	Stream function	Free liquid jets, Maximum height attained by the jet	Flow through syphon
	SLO-2	Variation of viscosity with temperature and pressure	Hydrostatic pressure force: inclined surfaces	Flow net	Time of flight, time to reach highest point, horizontal range of the jet	Branching of pipes
S-3	SLO-1	Solving problems using tutorial sheet 1	Solving problems using tutorial sheet 4	Solving problems using tutorial sheet 7	Solving problems using tutorial sheet 10	Solving problems using tutorial sheet 13
	SLO-2	Solving problems using tutorial sheet 1	Solving problems using tutorial sheet 4	Solving problems using tutorial sheet 7	Solving problems using tutorial sheet 10	Solving problems using tutorial sheet 13
S-4	SLO-1	Surface tension on liquid droplet, hollow bubble and liquid jet	Hydrostatic pressure force on curved surfaces	Control volume, continuity equation in cartesian coordinate system	Flow through pipes	Two reservoir problem
	SLO-2	Capillarity	Buoyancy, center of buoyancy	Forced vortex flow and free vortex flow	Laminar flow in circular pipes, Hagen–Poiseuille equation	Three reservoir problem
S-5	SLO-1	Bulk modulus of elasticity, compressibility	Metacenter and metacentric height	Fluid dynamics	Turbulent flow in pipes, Velocity distribution for turbulent flow	Water hammer in pipes

	SLO-2	*Vapour pressure, boiling point and cavitation*	*Stability of floating and submerged bodies*	*Euler's equation and Bernoulli's equation*	*Reynolds experiment, frictional loss in pipe flow, Darcy Weisbach equation, minor energy losses*	*Power transmission through pipe*
S-6	SLO-1	*Solving problems using tutorial sheet 2*	*Solving problems using tutorial sheet 5*	*Solving problems using tutorial sheet 8*	*Solving problems using tutorial sheet 11*	*Solving problems using tutorial sheet 14*
	SLO-2	*Solving problems using tutorial sheet 2*	*Solving problems using tutorial sheet 5*	*Solving problems using tutorial sheet 8*	*Solving problems using tutorial sheet 11*	*Solving problems using tutorial sheet 14*
S-7	SLO-1	*Fluid pressure at a point, Pascal's law*	*Fluid kinematics*	*Practical applications of Bernoulli's equation, venturimeter*	*Loss due to sudden enlargement and contraction*	*Condition for maximum power transmission*
	SLO-2	*Pressure variation in a fluid at rest; absolute and gauge pressures*	*Classification of fluid flow*	*Horizontal, vertical and inclined venturimeters*	*Loss of head at the entrance and exit of the pipe*	*Boundary layer theory Boundary layer definitions, characteristics*
S-8	SLO-1	*Piezometer, U-tube manometer*	*Velocity and acceleration*	*Orificemeter*	*Loss of head due to an obstruction in a pipe*	*Boundary layer thickness and displacement thickness*
	SLO-2	*Single column manometer*	*Local acceleration and convective acceleration*	*Pitot tube*	*Hydraulic Gradient Line (HGL) and Total Energy Line (TEL)*	*Momentum thickness and energy thickness*
S-9	SLO-1	*Solving problems using tutorial sheet 3*	*Solving problems using tutorial sheet 6*	*Solving problems using tutorial sheet 9*	*Solving problems using tutorial sheet 12*	*Solving problems using tutorial sheet 15*
	SLO-2	*Solving problems using tutorial sheet 3*	*Solving problems using tutorial sheet 6*	*Solving problems using tutorial sheet 9*	*Solving problems using tutorial sheet 12*	*Solving problems using tutorial sheet 15*

Learning Resources	1. *Modi, P.N., Seth S.M., Hydraulics and Fluid Machines, Standard book house, 2005* 2. *Subramanya, K., Theory and application of fluid mechanics, Tata McGraw Hill, 2002*	3. *Rajput R.K., Fluid Mechanics and Hydraulic Machines, S.Chand, 2014* 4. *Bansal R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publication, 2017* 5. *NPTEL Course - Introduction to Fluid Mechanics https://onlinecourses.nptel.ac.in/noc19_me15/preview*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Abdul Hakeem, National Remote Sensing Center, Hyderabad, abdulhakeem_k@nrsc.gov.in	*1. Dr. R. Saravanan, Anna University, rsaran@annauniv.edu*	*1. Dr. R. Sathyanathan, SRMIST*
2. Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru, sat@satyukt.com	*2. Dr. S. Saravanan, NIT Trichy, saravanans@nitt.edu*	*2. Dr. Deeptha Thattai, SRMIST*

Course Code	18CEC202L	Course Name	FLUID MECHANICS LABORATORY	Course Category	C	Professional Core	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	18CEC202T	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Utilize pressure measurement for real-time applications
CLR-2 :	Utilize buoyancy for real-time applications
CLR-3 :	Analyze the applications of Bernoulli's principle
CLR-4 :	Utilize the functions of orificemeter, venturimeter and pitot tube
CLR-5 :	Identify the losses in pipes
CLR-6 :	Utilize the functions of orifice and mouthpiece

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Apply the concept of Pascal's law	3	90	85	H	M		-	-	-	-	-	H	-	-	-	H	-	H
CLO-2 :	Identify the applications of buoyancy	3	85	80	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H
CLO-3 :	Identify the applications of Bernoulli's principle	3	90	85	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H
CLO-4 :	Identify the working principle, components and functions of orificemeter, venturimeter and pitot tube	3	85	80	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H
CLO-5 :	Estimate the losses in pipes	3	85	80	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H
CLO-6 :	Identify the working principle, and functions of orifice and mouthpiece	3	85	80	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H

Duration (hour)		6	6	6	6	6
S 1-2	SLO-1	Determine pressure using U-tube manometer	Verify Bernoulli's equation	Determine coefficient of discharge for orificemeter	Determine coefficient of velocity for pitot tube	Determine loss coefficient for sudden enlargement
	SLO-2					
S 3-4	SLO-1	Determine metacentric height for a ship model	Determine coefficient of discharge for venturimeter	Measure flow using orificemeter	Determine friction factor of the pipe material	Determine coefficient of discharge of orifice
	SLO-2					
S 5-6	SLO-1	Determine metacentric height for a rectangular log	Measure flow using venturimeter	Determine coefficient of discharge for rotameter	Determine loss coefficient for sudden contraction	Determine coefficient of discharge of mouthpiece
	SLO-2					

Learning Resources	
1.	Modi, P.N., Seth S.M., Hydraulics and Fluid Machines, Standard book house, 2005
2.	Subramanya, K., Theory and application of fluid mechanics, Tata McGraw Hill, 2002
3.	Rajput. R. K, Fluid Mechanics and Hydraulic Machines, S. Chand and Company Ltd.,2013
4.	Laboratory Manual for Hydraulic Engineering Laboratory, SRMIST

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Understand										
Level 2	Apply	-	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
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2. Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru, sat@satyukt.com	*2. Dr. S. Saravanan, NIT Trichy, saravanans@nitt.edu*	*2. Mr. Shaik Niyazuddin Guntakal, SRMIST*

Course Code	18CEC203T	Course Name	MECHANICS OF STRUCTURES	Course Category	C	Professional Core	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	18CEC203L	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Utilize the concepts of stresses in compound sections and principal stresses and principal strains			
CLR-2 :	Analyze determinate beams for bending moment and shear force			
CLR-3 :	Utilize Computation of stresses in beam cross section			
CLR-4 :	Utilize Computation of slope and deflection of beams and analysis of determinate and indeterminate trusses			
CLR-5 :	Analyze columns and application of theories of failures			
CLR-6 :	Utilize concepts of static indeterminacy and analysis of indeterminate beams			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Analyze the state of stress, evaluate principal stresses and principal strains including stresses in compound sections	3	80	75	H	H	-	-	-	-	-	-	-	-	-	-	H	-	H
CLO-2 :	Determine bending moment and shear force distribution along the beam	3	85	75	H	H	-	-	-	-	-	-	-	-	-	-	H	-	H
CLO-3 :	Determine bending and shear stress distribution across the cross section of rectangular, 'I', 'T' sections.	3	75	75	H	H	-	H	-	-	-	-	-	-	-	-	H	-	H
CLO-4 :	Compute slope, deflection of beams (Macaulay's, conjugate beam method) analyze determinate, indeterminate trusses	3	90	80	H	H	-	-	-	-	-	-	-	-	-	-	H	-	H
CLO-5 :	Analyze columns using Euler's, Rankine's theories of columns, theories of failure in real time applications	3	85	75	H	H	-	-	-	-	-	-	-	-	-	-	H	-	H
CLO-6 :	Apply Macaulay's method, Clapeyron's theorem to solve indeterminate beam problems	3	80	75	H	H	-	-	-	-	-	-	-	-	-	-	H	-	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	STRESSES IN COMPOUND SECTIONS Principles of composite sections	DETERMINATE BEAMS – BENDING AND SHEAR FORCE DIAGRAMS Determinate structures, Types of beams, load and its types.	DETERMINATE BEAMS – SLOPE AND DEFLECTION Definition of slope and deflection:	COLUMNS Classifications of columns, failure of column	INDETERMINATE BEAMS Introduction to static & kinematic indeterminacy
	SLO-2	Analysis of compound sections	Shear force and bending moments: definitions, sign conventions	Definition of elastic line, differential equation of flexure	Euler's column theory limitations, end conditions, effective length, slenderness ratio	Static and kinematic indeterminacy of two and three dimensional pin jointed structures
S-2	SLO-1	Thermal stresses and strains	BM diagrams plotted on tension side, SF diagrams, cantilever beams	Slope and deflections of determinate structures - Macaulay's method	Solving Problems	Static and kinematic Indeterminacy of two and three dimensional rigid jointed structures
	SLO-2	Simple and compound bars.	SF and BM Diagrams for simply supported beams	Solving Problems	Solving Problems	Analysis of indeterminate beams, propped cantilever beams - Macaulay's Method
S-3	SLO-1	Tutorials	Tutorials	Tutorials	Tutorials	Tutorials
	SLO-2					
S-4	SLO-1	STRESSES AT A POINT Introduction to principal stresses and strains	SF and BM Diagrams for over-hanging beams	Slope and deflections of determinate structures - Conjugate beam method.	Rankine's formula, factor of safety	Analysis of fixed beam by Macaulay's method

	SLO-2	*Two dimensional stresses without shear stress*	*beams with internal hinges, point of contra flexure*	*Solving Problems*	*Column with eccentricity, core / kernel section.*	*Introduction to Clapeyron's theorem of three moments*
S-5	SLO-1	*Two dimensional stressesLike and unlike stresses, with shear stress*	*Relationship between load, shear force and bending moment.*	*PIN JOINTED TRUSSES* *Analysis of determinate trusses.*	*THEORIES OF FAILURES* *Introduction to theories of failures*	*Analysis - Continuous beams*
	SLO-2	*Introduction to three dimensional stresses*	*BENDING / SHEAR STRESSES:* *Pure bending, bending equation – Bending / Shear stress distribution*	*Determination of deflection at the tip of the cantilever determinate truss*	*Application of maximum principal stress theory*	*Analysis of Continuous beams with settlement of supports*
S-6	SLO-1	*Tutorials*	*Tutorials*	*Tutorials*	*Tutorials*	*Tutorials*
	SLO-2					
S-7	SLO-1	*Three dimensional stresses, stress invariants.*	*Neutral axis, moment of resistance, section modulus*	*Indeterminate Trusses - Energy method - Analysis of indeterminate pin jointed - Plane trusses of degree of indeterminacy equal to 1*	*Application of maximum principal strain theory*	*Solving problems on two span continuous beam with simple supports*
	SLO-2	*Stresses in thin cylinder and spherical shells*	*Bending stresses, symmetrical sections.*	*Analysis of Trusses due to lack of fit*	*Application of stress difference theory*	*Solving problems on two span continuous beam end support (s) fixed*
S-8	SLO-1	*Concept of product of inertia, parallel axes theorem*	*Shear stresses: Shear stress at a section, shear flow*	*Analysis of Trusses subjected to temperature effects.*	*Application of strain energy theory*	*Solving three span continuous beams with simple end supports and fixed end supports.*
	SLO-2	*Principal moment of inertia*	*shear stress distribution for different sections.*	*Concept of solving indeterminate trusses with degree of indeterminacy greater than one*	*Application of shear strain energy theory*	*Principle of forming deflection equation - Macaulay's method.*
S-9	SLO-1	*Tutorials*	*Tutorials*	*Tutorials*	*Tutorials*	*Tutorials*
	SLO-2					

Learning Resources	1. *Devdas Menon, Structural Analysis, 1st ed., Narosa, 2013* 2. *R.C.Hibbeler,Structural Analysis, 9th ed., Pearson India, 2017* 3. *R.C.Hibbeler, Mechanics of Materials, 9th ed.,Pearson India, 2018* 4. *Ramamamrutham.S, Narayan.R, Strength of Materials, 18th ed., Dhanpat Rai Publishing Company, 2014*	5. *Rajput.R. K, Strength of Materials: Mechanics of Solids,5th ed., S. Chand Limited, 2010* 6. *Punmia.B.C, Ashok.K.Jain, Arun.K.Jain, Theory of Structures, 12th ed., Laxmi Publicaitions, 2014* 7. *NPTEL Course: Mechanics of Solids. https://onlinecourses.nptel.ac.in/noc17_ce17/preview* 8. *NPTEL Course: Strength of Materials https://onlinecourses.nptel.ac.in/noc18_ce17/preview*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. G.Hariharanath, GA Consultants, Chennai, gac1996@hotmail.com	*1. Dr. G. Appa Rao, Professsor, IIT Madras, garao@iitm.ac.in*	*1. Dr. K. Gunasekaran, SRMIST*
2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. C. Uma Rani, Professor, Anna University, umarani@annauniv.edu*	*2. Dr. P. R. Kannan Rajkumar, SRMIST*

Course Code	18CEC203L	Course Name	STRENGTH OF MATERIALS LABORATORY	Course Category	C	Professional Core	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	18CEC203T	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Utilize the testing procedure to determine modulus of elasticity of steel, double shear test and hardness test	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Utilize the testing procedure of torsional, impact strength of steel and also compressive strength of bricks and concrete			
CLR-3 :	Utilize non-destructive testing technique of rebound hammer and UPV tests			
CLR-4 :	Determine the stiffness and deflection of helical springs			
CLR-5 :	Determine modulus of elasticity of concrete, split tensile strength and flexural strength of concrete			
CLR-6 :	Utilize the testing procedure to determine bond strength between steel bar and concrete (pull-out test)			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Determine modulus of elasticity of steel, double shear test and hardness test	3	90	85
CLO-2 :	Identify torsional, impact strength of steel, identify compressive strength of bricks and concrete	3	85	80
CLO-3 :	Apply the knowledge of non-destructive testing technique of rebound hammer and UPV tests	3	90	85
CLO-4 :	Compute stiffness and deflection of helical springs	3	85	80
CLO-5 :	Determine modulus of elasticity of concrete, split tensile strength and flexural strength of concrete	3	85	80
CLO-6 :	Find bond strength between steel bar and concrete (pull-out test)	3	85	80

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	M		-	M	-	-	-	H	-	-	-	H	-	H
H	M	-	-	M	-	-	-	H	-	-	-	H	-	H
H	H	-	-	M	-	-	-	H	-	-	-	H	-	H
H	M	-	-	M	-	-	-	H	-	-	-	H	-	H
H	M	-	-	M	-	-	-	H	-	-	-	H	-	H
H	M	-	-	M	-	-	-	H	-	-	-	H	-	H

Duration (hour)		6	6	6	6	6
S 1-2	SLO-1	Determination of strength of steel specimen under impact test -Izod Test	Determination of strength of steel specimen under double shear test.	Determination of stiffness and deflection of helical springs.	Determination of split tensile strength of concrete cylinder.	Non Destructive Test using rebound hammer and UPV.
	SLO-2					
S 3-4	SLO-1	Determination of strength of steel specimen under torsion test	Determination of strength of concrete cube and bricks under compression tests.	Determination of strength of steel specimen under impact test - Charpy Test	Determination of flexural strength of concrete beam (two point load test).	To study the behavior of Castellated Steel Beam
	SLO-2					
S 5-6	SLO-1	Determination of hardness strength test on specimen using Rockwell & Brinell	Deflection Test on steel, aluminum specimens under central and non-central point load.	Determination of modulus of elasticity of steel from stress-strain graph by conducting tension test on steel.	Determination of bond strength between steel bar and concrete (pull-out test).	To study the stress patterns on different models using photo elasticity test-Demo
	SLO-2					

Learning Resources	
	1. IS 5816:1999 (Reaffirm – 2004), Splitting Tensile Strength of Concrete-Method of Test, Bureau of Indian Standards, New Delhi. 2. Strength of Materials Laboratory - Laboratory Manual, SRMIST 3. IS 516:1959 (Reaffirm – 2004), Method of Tests for Strength of Concrete, Bureau of Indian Standards, New Delhi. 4. IS 1500:2005, Method for Brinell Hardness Test for Metallic Materials -Method of Test, Bureau of Indian Standards, New Delhi.

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Understand										
Level 2	Apply	-	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Course Code	18CEC204T	Course Name	ENGINEERING SURVEYING	Course Category	C	Professional Core	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	18CEC204L	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Utilize chain, compass & Plane table surveying			
CLR-2 :	Utilize concepts of Levelling			
CLR-3 :	Utilize working procedures of theodolite surveying			
CLR-4 :	Utilize operations of tachometric surveying			
CLR-5 :	Utilize the knowledge of surveying in carrying out Civil Engineering works			
CLR-6 :	Estimate the capacity of reservoirs, areas of embankments & setting out foundation trenches and curves			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Apply the principles and making of linear, direction measurements and creation of Plan/Map	2	90	80	H	H	-	-	L	-	-	-	-	M	-	-	H	-	-
CLO-2 :	Determine or set the altitude of the point/or set of points w.r.t the given datum	3	85	75	H	H	-	-	M	-	-	-	-	M	-	-	H	-	-
CLO-3 :	Measure the horizontal and vertical angle and derive the measurements at times of obstacle and inaccessible points	3	80	75	H	H	-	-	M	-	-	-	-	M	-	-	H	-	-
CLO-4 :	Apply knowledge of optics to make the angular measurements in rolling/hilly terrain	3	85	80	H	H	-	-	M	-	-	-	-	M	-	-	H	-	-
CLO-5 :	Set horizontal, vertical control and setting out works	2	85	80	H	H	-	-	H	-	M	-	-	M	-	M	H	-	-
CLO-6 :	Calculate areas, volumes and setting out curves	3	80	75	H	H	-	-	H	-	M	-	-	M	-	M	H	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Surveying Definition, Principles of Surveying	Methods: Radiation, Intersection	Theodolite Vernier & microptic, description and uses Temporary Adjustments of Vernier transit	Horizontal & Vertical for staff held Inclined Elevation & Depression on Fixed Hair Systems, with and without Analytic Lens	Layout, setting out works for foundation trenches
	SLO-2	Classification of Surveying, Chain: Description, types of Chain & Accessories	Resection: two point &three-point Problem	Permanent Adjustments of the Vernier transit	Horizontal & Vertical for Normal staff Elevation & Depression. On Fixed Hair Systems, with &without Analytic Lens	Curves: Description & Components, Horizontal and Vertical curves, types
S-2	SLO-1	Conventional signs, Field & office work chaining	Levelling: Level Line, Horizontal Line, horizontal plane	Horizontal angles measurements: Radiation & Repetition Method	Movable Hair methods: Principle, Stadia constants, Analytic Lens	Simple curves: Terms & Components
	SLO-2	Ranging: Direct &Reciprocal ranging Procedures	Vertical Plane, datum, vertical line, elevation. Levels and Staves & types	Traversing, Closing error & distribution, Trigonometrical levelling: Heights & Distances	Tangential Systems: Both Angles are Angles of Elevation	Methods of Simple curves: setting with chain and tapes, Setting out procedure
S-3	SLO-1	Tutorial: Solving Problems	Tutorial: Solving Problems	Tutorial: Solving Problems	Tutorial: Solving Problems	Tutorial: Solving Problems
	SLO-2					
S-4	SLO-1	Setting perpendiculars, Well- conditioned triangles	Spirit level, sensitiveness, Bench marks & important Terminology in Levelling	Base of the Object accessible, Base of the object Inaccessible: Instrument station in the same vertical Plane as Elevated Object. (Single Plane Method)	Tangential Systems: Both Angles are angles of Depression	Methods of Simple curves Rankies method: Tangential angles by theodolite(Single Theodolite Method)

	SLO-2	*Compass: Prismatic compass, Surveyor's compass*	*Temporary Adjustments of Vernier Transit*	*Base of the object Inaccessible: Instrument station in the same vertical Plane as Elevated Object*	*Tangential Systems: One Angle of Elevation and Other of Depression*	*Methods of Simple curves Rankies method: tangential angles by theodolite(Double Theodolite Method)*
S-5	SLO-1	*Meridians, Bearings & Types, Bearing systems &Types*	*Permanent adjustments of Vernier transit*	*Base of the object Inaccessible: Instrument station in the same vertical Plane as Elevated Object: Axis at different Levels*	*Substence Bar Method*	*Setting out procedure by rankies method, compound and reverse curves, Transition curves*
	SLO-2	*Conversions, Bearings to angles, Local Attraction: Definition & Corrections applied for Local Attraction*	*Longitudinal & cross-sectional Levelling & plotting*	*Base of the object Inaccessible: Instrumental Station not in the same vertical plane as the elevated object. (Double Plane Method)*	*Self-Reducing Tachometers*	*Contours: Definition, Contour Interval & Consideration Factors*
S-6	SLO-1	*Tutorial: Solving Problems*	*Tutorial: Solving Problems*	*Tutorial: Solving Problems*	*Tutorial: Solving Problems*	*Tutorial: Solving Problems*
	SLO-2					
S-7	SLO-1	*Adjustment of error, Graphical Method*	*Fly & Check Levelling, Height of collimation, rise & fall Method Booking & Reduction Types*	*Tacheometric Systems: Merits of tacheometric Systems, Types Tangential, Stadia & Substense methods*	*Engineering Surveys: Reconnaissance, Preliminary surveys for Engineering Projects*	*Contours, Contouring Methods*
	SLO-2	*Magnetic declination, dip, Traversing, Types & Plotting*	*Gradient & Missing Values on booking & Reduction*	*Stadia Systems: types, Principle of stadia systems*	*Location surveys for Engineering Projects*	*Characteristics of contours*
S-8	SLO-1	*Plane Table Surveying: Plane table instruments and accessories*	*booking & Reduction on levelling for inverted staff*	*Fixed Hair systems: stadia constants, analytic lens*	*Setting out Works, Aims Horizontal Control, Vertical control*	*Uses of contours*
	SLO-2	*Merits and demerits of Plane Table, & Operations of Plane Table*	*Curvature, Refraction & combined correction, Reciprocal Levelling*	*Horizontal & Vertical for staff held Inclined Elevation & Depression on Fixed Hair Systems*	*Base Lines & Types of Grids for carrying setting out works*	*Plotting – Calculation of areas and volumes*
S-9	SLO-1	*Tutorial: Solving Problems*	*Tutorial: Solving Problems*	*Tutorial: Solving Problems*	*Tutorial: Solving Problems*	*Tutorial: Solving Problems*
	SLO-2					

Learning Resources	1. *Kanetkar T., Surveying and Levelling, Vols. I &II, United Book Corporation, Pune, 2007* 2. *Punmia B.C, Surveying, Vols. I, 17th ed., Laxmi Publications, 2016* 3. *Chandra A.M, Plane Surveying and Higher Surveying, 3rd ed., New Age International (P) Limited, 2015* 4. *Clark.D, Plane and Geodetic Surveying, Vols. I & II, 17th ed., C.B.S. Publishers and Distributors, 2002*	5. *Punmia B.C, Surveying, Vols. II, 16th ed., Laxmi Publications, 2016* 6. *James M. Anderson, Edward M. Mikhail, Introduction to Surveying, 3rd ed., McGraw Hill, 2001* 7. *N N Basak, Surveying & Levelling, 1st ed., Tata Mc Graw Hill, 2015* 8. *Arora K.P, Surveying, Vol. 3,11th ed., Standard Book House, 2013* 9. *NPTEL course: Surveying (Web). https://nptel.ac.in/courses/105107122/1*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Er. Hariharanath, GA Consultants, Chennai, gac1996@hotmail.com	*1. Dr. K. Srinivasa Raju, Anna University, raju_irs@yahoo.com*	*1. Mr. K Prasanna, SRMIST*	*2. Ms. S Durga Devagi, SRMIST*
2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. E.S.M. Suresh, NITTTR, Chennai, esmsuresh@gmail.com*	*3. Mr V Satya Ramesh Potti, SRMIST*	

Course Code	18CEC204L	Course Name	ENGINEERING SURVEYING LABORATORY	Course Category	C	Professional Core	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	18CEC204T	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Utilize the principles of chain Surveying			
CLR-2 :	Utilize the principles of Compass surveying			
CLR-3 :	Utilize the application of principles of Plane table surveying			
CLR-4 :	Utilize the principles of Levelling			
CLR-5 :	Utilize the principles of operation of theodolite			
CLR-6 :	Apply theodolite principle for measuring height and distance			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	traverse and prepare the site layout	3	90	85	H	H	L	-	L	-	-	-	H	H	-	-	H	-	H
CLO-2 :	traverse, resulting in precise location of points using prismatic compass	3	85	80	H	H	L	-	L	-	-	-	H	H	-	-	H	-	H
CLO-3 :	Prepare site layouts	3	80	75	H	H	M	-	M	-	-	-	H	H	-	-	H	-	H
CLO-4 :	Profile land levels and contouring	3	85	80	H	H	M	-	M	-	-	-	H	H	-	-	H	-	H
CLO-5 :	Determine horizontal distance of the inaccessible target	3	85	80	H	H	H	-	M	-	-	-	H	H	-	L	H	-	H
CLO-6 :	Estimate the height of inaccessible target	3	80	75	H	H	H	-	M	-	-	-	H	H	-	L	H	-	H

Duration (hour)		6	6	6	6	6
S 1-2	SLO-1	Chain surveying, Calculation of area using cross staff by Perpendicular offset	Traversing, Prismatic compass, Running closed and open compass traverse, plotting and adjustments of traverse	Resection, Field solution of two point problems	Reduction of levels by Rise and Fall method	Theodolite, Measure vertical angles and Height of the object
	SLO-2					
S 3-4	SLO-1	Chain surveying, Calculation of area using cross staff by oblique offset	Plane table Surveying by Intersection Method	Resection, Field solution of Three point problems (Trial and Error method)	Theodolite, Measure horizontal angles by repetition method	Height and distance by Single Plane Method
	SLO-2					
S 5-6	SLO-1	Traversing, measurement of bearing of survey lines by prismatic compass and correction of Local Attraction	Plane table Surveying by Radiation Method	Reduction of levels by Height of Collimation method	Theodolite, Measure horizontal angles by reiteration method	Height and distance by Double Plane Method
	SLO-2					

Learning Resources	1. Punmia B.C, Surveying, Vols. I, 17th ed., Laxmi Publications, 2016 2. Bhavikatti, S.S, Surveying and Leveling, Vol. I and II, I.K. International, 2010	3. Surveying Manual - SRMIST

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Understand										
Level 2	Apply	-	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. E.S.M. Suresh, NITTTR, Chennai, esmsuresh@gmail.com*	*2. Dr. J. Satish Kumar, SRMIST*

Course Code	18CEC205T	Course Name	STRUCTURAL ANALYSIS	Course Category	C	Professional Core	L	T	P	C
							2	1	0	3

Pre-requisite Courses	18CE203T	Co-requisite Courses	18CEC205L	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	IS 9282: 2002 Indian Standard Wire Ropes and Strands for Suspension Bridges – Specifications		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Understand the behavior of indeterminate structures using slope deflection method	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Apply moment distribution method in the analysis of indeterminate structures			
CLR-3 :	Get exposed to stiffness matrix method			
CLR-4 :	Analyze indeterminate structures using flexibility matrix method			
CLR-5 :	Understand the behavior of determinate and indeterminate structures under moving loads			
CLR-6 :	Get an insight into the behavior of arches and suspension bridges			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Apply slope deflection method to analyze indeterminate beams and plane rigid jointed frames	3	90	75	H	H	-	M	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Use moment distribution method to analyze indeterminate beams and plane rigid jointed frames	3	95	75	H	H	-	M	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Make use of computer based matrix stiffness method and direct stiffness method to analyze indeterminate beams and plane rigid jointed frames	3	90	75	H	H	-	M	M	-	-	-	-	-	-	-	H	M	-
CLO-4 :	Apply energy concepts and matrix flexibility method to analyze indeterminate beams and plane rigid jointed frames	3	80	75	H	H	-	M	-	-	-	-	-	-	-	-	H	-	-
CLO-5 :	Draw influence line diagrams for determinate and indeterminate structures and apply the same for determinate and indeterminate structures for finding stress resultants due to moving loads	3	95	75	H	H	-	M	-	-	-	-	-	-	-	-	H	-	-
CLO-6 :	Analyze three hinged parabolic, circular archesand two hinged parabolic arches and study concepts behind the analysis of fixed arches Analyze suspension cables and get an insight into to suspension bridges with two and three hinged girders	3	85	75	H	H	-	M	-	-	-	-	-	-	-	-	H	-	-

		Influence Lines Diagrams (ILD) and Moving Loads	Arches and Suspension Bridges	Flexibility Matrix Method	Slope Deflection and Moment Distribution Methods	Direct and Element Stiffness Matrix Methods
Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to influence line diagram (ILD) and Muller Breslau's principle	Introduction to arches: three hinged, two hinged, fixed. Eddy's theorem	Revisiting Castigliano's energy theorems	Fixed end moments, effect of rotations and settlement on support moments	Relation between SDM, matrix stiffness method, derive direct stiffness method
	SLO-2	ILD for BM and SF for cantilever	theoretical arch, analyze three hinged parabolic arches with supports at same level	Form basic determinate structure of an indeterminate structure by releasing the redundant reactions or inserting hinges	Principle of superposition and joint equilibrium, derivation of slope deflection method (SDM)	Advantages of Stiffness method over flexibility method, Analysis of propped cantilever using direct stiffness method
S-2	SLO-1	ILD for BM and SF for simply supported, overhanging beam. Introduction to IRC trailer load	Analyze three hinged parabolic arches with supports at different levels	Derive flexibility coefficients using unit load method.	Apply SDM for drawing bending moment diagram (BMD) and shear force diagram (SFD) for propped cantilevers with and without overhang	Analyze continuous beams using direct stiffness method
	SLO-2	Find max. BM, SF using ILD for cantilever, simply supported, overhanging beam subject to moving point loads and udl	Analyze three hinged circular arches with supports at the same level	Determine deflection of basic determinate beams using flexibility coefficients	Apply SDM for the analysis of beams up to a degree of static indeterminacy of 2 including the effect of support settlements	Apply direct stiffness method for single storey portal frame

S-3	SLO-1	*Tutorial class*	*Tutorial class*	*Tutorial class*	*Tutorial class*	*Tutorial class*
	SLO-2					
S-4	SLO-1	*Concept of absolute maximum BM in simply supported beams*	*Derive horizontal reaction for two hinged parabolic arches including support movement, temperature change and rib shortening*	*Derive direct flexibility matrix equation. Solving propped cantilever using flexibility method*	*Solve rigid jointed plane frame with degree of static indeterminacy 2 using SDM*	*Introduction to element stiffness method- coordinate systems – element and global*
	SLO-2	*Find absolute maximum BM and SF in a simply supported beam subjected to series of moving loads*	*Analyze two hinged parabolic arches with a single point load*	*Formulate flexibility matrix for a two-span continuous beam with one of the end supports fixed*	*Moment Distribution Method (MDM), definition of stiffness, carry over factors with demonstrative analysis of propped cantilever*	*Derive element stiffness matrix for truss, beam, frame elements in local coordinates*
S-5	SLO-1	*Find absolute maximum BM /SF in a simply supported beam subjected to udl – shorter and longer than the span*	*Analyze two hinged parabolic arches with udl occupying the entire span*	*Analyze two span continuous beam with one of the end supports fixed using direct flexibility method*	*Analyze 2 span- continuous beams using MDM*	*Rotation matrix for truss element and transformation of element stiffness matrix in local coordinates to global coordinates*
	SLO-2	*ILD of propped cantilevers*	*Analyze two hinged parabolic arches with part udl occupying anywhere in the span*	*Form flexibility matrix for single storey portal frame with static indeterminacy of 2 with supports at same level and analyzing*	*Analyze 3 span- continuous beams using MDM includingeffect of support settlements*	*Rotation matrix for frame element and transformation of element stiffness matrix in local coordinates to global coordinates*
S-6	SLO-1	*Tutorial class*	*Tutorial class*	*Tutorial class*	*Tutorial class*	*Tutorial class*
	SLO-2					
S-7	SLO-1	*ILD for two span continuous beam for end support reaction*	*Introduction to suspension cables*	*Form flexibility matrix for single storey portal frame with static indeterminacy of 2 with supports at different levels and analyzing*	*Analyze non-sway frames using MDM*	*Compute load vector in global coordinates for truss problems. Assemble global stiffness matrix for truss problem*
	SLO-2	*ILD for two span continuous beam for mid support reaction*	*Analyze suspension cables with udl – maximum and minimum cable tension and support reactions – resultant (Supports at same level)*	*Find support reactions for a single storey portal frame with static indeterminacy of 3 with supports at same level and subjected to a lateral point load at beam level*	*Introduction to sway in portal frames*	*Compute joint load vector in beam/frame problems with uniformly distributed and point loads*
S-8	SLO-1	*ILD for two span continuous beam for mid support moment*	*Analyze suspension cables with udl – maximum and minimum cable tension and support reactions – resultant (Supports at different levels)*	*Form flexibility matrix for a single storey portal frame with a static indeterminacy of 3 with supports at same level and subjected to udl over the beam*	*Fixed end moments due to sway in single storey frames and analysis of single storey portal frames with sway using MDM*	*Assemble global stiffness matrix for two span continuous beams. Partition global stiffness matrix and find unknown displacements and reactions*
	SLO-2	*ILD for two span continuous beam for span BM and span shear*	*Find forces at anchor towers – saddle support with rollers and hinged supports. Introduction to two hinged and three hinged stiffening girders*	*Find support reactions for a single storey portal frame with static indeterminacy of 3 with supports at same and different levels and subjected to either udl over the beam or lateral load at beam level*	*KANI'S METHOD Introduction to Kani's method for multistory frames and definition of rotation factors and sway corrections*	*Assemble global stiffness matrix for single storey portal frame, partitioning, solve for unknown displacements and find element forces from known displacements upto a static indeterminacy of 3*
S-9	SLO-1	*Tutorial class*	*Tutorial class*	*Tutorial class*	*Tutorial class*	*Tutorial class*
	SLO-2					

Learning Resources	1. *Menon D, Structural Analysis, Alpha Science International Limited, 2009* 2. *Pandit G.S., Gupta S.P., Structural Analysis- A Matrix Approach, 2nd ed., Tata McGraw-Hill, 2010* 3. *Punmia B.C., Ashok Kumar Jain, Arun Kumar Jain, Theory of Structures, 12th ed., Laxmi Publications, 2004* 4. *Vaidyanathan R, Perumal. P, Comprehensive Structural Analysis-Volume I & II, Laxmi Publications, 2004*	5. *Bhavikatti S. S, Structural Analysis, Vol-1 &2, E-2, Vikas Publishing House Pvt Limited, 2009* 6. *Hibbeler R.C., Structural Analysis, 8th ed., Prentice Hall, 2012* 7. *NPTEL Course: Structural Analysis – I. https://onlinecourses.nptel.ac.in/noc17_ce25/preview* 8. *NPTEL Course: Structural Analysis – II https://nptel.ac.in/downloads/105105109/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. C. Uma Rani, Professor, Anna University, umarani@annauniv.edu*	*2. Prof. G. Augustine Maniraj Pandian, SRMIST*

Course Code	18CEC205L	Course Name	COMPUTER AIDED STRUCTURAL ANALYSIS LABORATORY	Course Category	C	Professional Core	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	18CEC205T	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Utilize the Calculate the Area of Steel of beams using MS Excel program
CLR-2 :	Utilize the method of solving Matrix Equation using Stiffness Matrix
CLR-3 :	Analyze behavior of 2D and 3D Moment Resistant Steel Frames using STAAD Pro or ETABS
CLR-4 :	Analyze behavior of Plane Steel Frames using STAAD Pro or ETABS
CLR-5 :	Utilize the flexural and shear behavior of RCC beam
CLR-6 :	Acquire knowledge on the torsional behavior of RCC beam

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Calculate the Area of Steel of beams using MS Excel program	3	90	85	H	M	H	-	H	-	-	-	H	-	-	-	H	H	H
CLO-2 :	Solve matrix equation using stiffness matrix	3	85	80	H	M	-	-	H	-	-	-	H	-	-	-	H	H	H
CLO-3 :	Report on the behavior of 2D and 3D Moment Resistant Steel Frames	3	90	85	H	M	-	-	H	-	-	-	H	-	-	-	H	H	H
CLO-4 :	Analyze the behavior of Plane Steel Frames	3	85	80	H	M	-	-	H	-	-	-	H	-	-	-	H	H	H
CLO-5 :	Analyze the Flexural and shear resistance of RCC beams	3	85	80	H	M	-	-	H	-	-	-	H	-	-	-	H	-	H
CLO-6 :	Design the beam for torsion	3	85	80	H	M	M	-	H	-	-	-	H	-	-	-	H	-	H

Duration (hour)		6	6	6	6	6
S 1-2	SLO-1	Programming in MS Excel for calculating Ast	Solving Matrix Problems in MS Excel	Exercise the solution in STAAD Pro or ETABS	Analysis in STAAD Pro or ETABS for moving IRC loads and verification	Study the behavior of RCC beam test under flexure
	SLO-2					
S 3-4	SLO-1	Solving Problems in MS Excel	2D and 3D Moment Resistant Steel Frames Using STAAD Pro or ETABS for real building model	Exercise the solution in STAAD Pro or ETABS	Plane Pin Jointed Steel Frames using STAAD Pro or ETABS	Study the behavior of RCC beam test under shear
	SLO-2					
S 5-6	SLO-1	Solving Matrix Equation using Stiffness Matrix	Exercise the solution in STAAD Pro or ETABS	Exercise the solution in STAAD Pro or ETABS and verification using text book problems	Exercise the solution in STAAD Pro or ETABS and verification using text book problems	Study the behavior of RCC beam test under torsion
	SLO-2					

Learning Resources	1. IS 456 :2000, Plain and Reinforced Concrete: Code of Practice, Bureau of Indian Standards, New Delhi.	2. Laboratory Manual - SRMIST

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Understand										
Level 2	Apply	-	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. G.Hariharanath, GA Consultants, Chennai, gac1996@hotmail.com	*1. Dr. G. Appa Rao, Professsor, IIT Madras, garao@iitm.ac.in*	*1. Dr. K. Sathyanarayanan, SRMIST*
2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. C. Uma Rani, Professor, Anna University, umarani@annauniv.edu*	*2. Prof. G. Augustine Maniraj Pandian, SRMIST*

Course Code	18CEC206T	Course Name	HYDRAULIC ENGINEERING AND DESIGN	Course Category	C	Professional Core	L	T	P	C
							2	1	0	3

Pre-requisite Courses	18CEC202T	Co-requisite Courses	18CEC206L	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Utilize dimensional and model analysis			
CLR-2 :	Address concepts related to open channel flow			
CLR-3 :	Utilize basic hydraulic concepts in measuring discharge and velocity in open channel			
CLR-4 :	Create insights into the components and functions of roto-dynamic pump			
CLR-5 :	Address concepts related to the components and functions of positive displacement pump			
CLR-6 :	Utilize the components, functions and uses of Pelton wheel, Kaplan and Francis turbines			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Identify and solve various fluid problems involving dimensional and model analysis	3	80	70	H	H	-	M	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Analyze problems related to open channel flow	3	85	75	H	H	H	L	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Identify various devices to measure and estimate discharge and velocity in open channel	3	85	75	H	M	-	-	-	-	-	-	-	-	-	-	H	-	-
CLO-4 :	Analyze the components and functions of rotodynamic pump	3	85	75	H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
CLO-5 :	Identify the components and functions of positive displacement pump	3	85	75	H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
CLO-6 :	Identify the components, functions and uses of various hydraulic turbines	3	80	70	H	H	H	L	-	-	-	-	-	-	-	-	H	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Dimensional and Model analysis	Open channel flow	Backwater computation by direct step method	Gauging flumes, non-modular/venturiflume	Air vessel and its functions
	SLO-2	Use of dimensional analysis, fundamental quantities and derived quantities	Comparison between open channel and pipe flows; Types of channels and types of flow in channels	Rapidly varied flow, hydraulic jump and its types	Standing wave / Modular flume	Working principle of hydraulic ram, jet pump and gear pump
S-2	SLO-1	M-L-T system for various quantities	Chezy's formula and Manning's formula	Expression for loss of energy due to jump, length of hydraulic jump, height of jump	Measurement of velocity, current meter	Turbines
	SLO-2	Dimensional homogeneity	Solving problems using tutorial sheet 4	Energy dissipaters and stilling basins	Floats, Hot-wire Anemometer	Components of hydroelectric power plant, classification of hydraulic turbines
S-3	SLO-1	Solving problems using tutorial sheet 1	Solving problems using tutorial sheet 4	Solving problems using tutorial sheet 7	Solving problems using tutorial sheet 10	Solving problems using tutorial sheet 13
	SLO-2	Solving problems using tutorial sheet 1	Design of most economical section of a channel	Solving problems using tutorial sheet 7	Solving problems using tutorial sheet 10	Solving problems using tutorial sheet 13
S-4	SLO-1	Rayleigh's method	Rectangular channel and trapezoidal channel	Measurement of discharge and velocity in open channel	Pumps	Pelton wheel, velocity triangles and work done
	SLO-2	Buckingham's π method	Non uniform flow through open channels	Flow over notches; Rectangular, triangular	Centrifugal pump, components and working	Design aspects of Pelton wheel
S-5	SLO-1	Selection of repeating variables; Application of dimensional analysis	Specific energy and specific energy curve	Trapezoidal and stepped notch	Velocity triangle, work done, losses and efficiencies	Francis turbine, velocity triangles and work done

	SLO-2	*Model analysis*	*Critical depth, critical velocity*	*Types of Weirs*	*Specific speed, multistage centrifugal pump – pumps in parallel and series*	*Design aspects of Francis turbine*
S-6	SLO-1	*Solving problems using tutorial sheet 2*	*Solving problems using tutorial sheet 5*	*Solving problems using tutorial sheet 8*	*Solving problems using tutorial sheet 11*	*Solving problems using tutorial sheet 14*
	SLO-2	*Solving problems using tutorial sheet 2*	*Solving problems using tutorial sheet 5*	*Solving problems using tutorial sheet 8*	*Solving problems using tutorial sheet 11*	*Solving problems using tutorial sheet 14*
S-7	SLO-1	*Similitude – Geometric similarity*	*Minimum specific energy, critical flow; Subcritical flow and supercritical flow*	*Effect on discharge over a notch or weir due to error in the measurement of head*	*Characteristic curves, NPSH*	*Kaplan turbine, design aspects of Kaplan turbine*
	SLO-2	*Kinematic and dynamic similarity*	*Gradually varied flow*	*Velocity of approach and end contraction*	*Reciprocating pump, components and working*	*Draft tube, types*
S-8	SLO-1	*Dimensionless numbers and their significance*	*Characteristics of surface profiles*	*Cippoletti weir, broad crested weir*	*Coefficient of discharge, slip, indicator diagram*	*Specific speed and its significance*
	SLO-2	*Model (or similarity) laws; Model studies in fluid flow problems*	*Length of back water curve and afflux*	*Narrow crested weir, Ogee weir and drowned/submerged weir*	*Effect of acceleration and friction, Maximum speed of reciprocating pump*	*Characteristic curves of hydraulic turbines*
S-9	SLO-1	*Solving problems using tutorial sheet 3*	*Solving problems using tutorial sheet 6*	*Solving problems using tutorial sheet 9*	*Solving problems using tutorial sheet 12*	*Solving problems using tutorial sheet 15*
	SLO-2	*Solving problems using tutorial sheet 3*	*Solving problems using tutorial sheet 6*	*Solving problems using tutorial sheet 9*	*Solving problems using tutorial sheet 12*	*Solving problems using tutorial sheet 15*

Learning Resources	1. *Modi, P.N., Seth S.M., Hydraulics and Fluid Machines, Standard book house, 2005* 2. *Subramanya, K., Theory and application of fluid mechanics, Tata McGraw Hill, 2002* 3. *R.K., Fluid Mechanics and Hydraulic Machines, S.Chand, 2014*	4. *Chandramouli P.N., Applied Hydraulic Engineering, Yesdee, 2017* 5. *NPTEL Course-Hydraulics. https://nptel.ac.in/courses/105106114/#* 6. *NPTEL Course-Fluid Machinery. https://nptel.ac.in/courses/112104117/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Abdul Hakeem, National Remote Sensing Center, Hyderabad, abdulhakeem_k@nrsc.gov.in	*1. Dr. R. Saravanan, Anna University, rsaran@annauniv.edu*	*1. Dr. R. Sathyanathan, SRMIST*
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Course Code	18CEC206L	Course Name	HYDRAULIC ENGINEERING LABORATORY	Course Category	C	Professional Core	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	18CEC206T	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Utilize the Chezy's and Manning's equations			
CLR-2 :	Analyze the concept of hydraulic jump			
CLR-3 :	Utilize knowledge on notches and flumes			
CLR-4 :	Utilize knowledge in operating the current meter			
CLR-5 :	Utilize centrifugal pump, reciprocating pump, submersible pump and gear oil pump for suitable applications			
CLR-6 :	Utilize Pelton wheel turbine and Francis turbine for suitable applications			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Apply the concept of Chezy's and Manning's equations	3	90	85	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H
CLO-2 :	Analyze hydraulic jump	3	90	85	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H
CLO-3 :	Evaluate discharge using notches and flumes	3	90	85	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H
CLO-4 :	Evaluate velocity using current meter	3	90	85	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H
CLO-5 :	Analyze the working of centrifugal pump, reciprocating pump, submersible pump and gear oil pump	3	90	85	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H
CLO-6 :	Analyze the working of Pelton wheel turbine and Francis turbine	3	90	85	H	M	-	-	-	-	-	-	H	-	-	-	H	-	H

Duration (hour)		6	6	6	6	6
S 1-2	SLO-1	Determine Chezy's constant for an open channel	Measure hydraulic jump	Determine coefficient of discharge for triangular notch	Test Performance of centrifugal pump	Test Performance of gear oil pump
	SLO-2					
S 3-4	SLO-1	Determine Manning's roughness coefficient for an open channel	Determine coefficient of discharge for rectangular notch	Measure velocity using current meter	Test Performance of reciprocating pump	Test Performance of Pelton wheel turbine
	SLO-2					
S 5-6	SLO-1	Determine specific energy curve	Measure flow using rectangular and triangular notches	Measure discharge using venturiflume	Test Performance of submersible pump	Test Performance of Francis turbine
	SLO-2					

Learning Resources	
	1. Modi, P.N., Seth S.M., Hydraulics and Fluid Machines, Standard book house, 2005 2. Subramanya, K., Theory and application of fluid mechanics, Tata McGraw Hill, 2002 3. Rajput R.K, Fluid Mechanics and Hydraulic Machines, S.Chand and Company Ltd.,2013 4. Laboratory Manual for Hydraulic Engineering Laboratory, SRMIST

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Understand										
Level 2	Apply	-	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Abdul Hakeem, National Remote Sensing Center, Hyderabad, abdulhakeem_k@nrsc.gov.in	*1. Dr. R. Saravanan, Anna University, rsaran@annauniv.edu*	*1. Dr. R. Sathyanathan, SRMIST*
2. Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru, sat@satyukt.com	*2. Dr. S. Saravanan, NIT, Tiruchy, ssaravanan@nitt.edu*	*2. Mr. Shaik NiyazuddinGuntakal, SRMIST*

Course Code	18CEC207T	Course Name	DESIGN OF RC AND STEEL STRUCTURES	Course Category	C	Professional Core	L	T	P	C
							4	0	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	IS 456 :2000, SP 16-Column Design Charts, IS 800: 2007, Steel Tables		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Utilize the behavior of RC sections under flexure and shear and to get introduced to the relevant IS codes			
CLR-2 :	Design RC using Limit state method			
CLR-3 :	Utilize the concepts in performing design of RC beams, slabs, columns and foundations			
CLR-4 :	Analyze behavior of Steel sections under tension, compression and flexure, identify relevant IS codes			
CLR-5 :	Design streel sections using Limit state method			
CLR-6 :	Utilize the concepts in performing design of steel tension, compression and flexural members and their connections			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Identify effect of external loads on RC members, factors influencing their behavior, identify relevant IS codes	3	85	80	H	-	-	M	-	-	-	-	-	-	-	H	H	M	-
CLO-2 :	Analyze behavior of RC sections under flexure and shear	2	80	75	H	H	-	M	-	-	-	-	-	-	-	H	H	M	-
CLO-3 :	Apply Limit state method of design to RC beams, slabs, columns and foundations	2	85	80	H	H	H	H	-	-	-	-	-	-	-	H	H	M	-
CLO-4 :	Identify effect of external loads on Steel members, factors influencing their behavior, identify relevant IS codes	3	85	80	H	-	-	M	-	-	-	-	-	-	-	H	H	M	-
CLO-5 :	Analyze the behavior of Steel sections under tension, compression and flexure	2	80	75	H	H	-	M	-	-	-	-	-	-	-	H	H	M	-
CLO-6 :	Apply Limit state method of design to steel tension, compression and flexural members and their connections	2	85	80	H	H	H	H	-	-	-	-	-	-	-	H	H	M	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	INTRODUCTION TO RC DESIGN Grade of concrete - concrete mix design-IS code provisions-Design of nominal and design mix	RC SLABS Reinforcement detailing of one way slabs	RC BEAMS Concept of load transfer from slab to beam-Introduction to singly and doubly reinforced and flanged beams -Design recommendations as per IS 456:2000	RC STAIR-CASES Design of dog-legged stair-case-Procedure	RC FOUNDATIONS Introduction-Types of foundation-Transfer of forces at junction of column-foundation
	SLO-2	Basic design concepts- Design Philosophy- Working stress and Limit state method of design	Design of continuous slabs-Procedure	Design of singly reinforced beams-Procedure	Design of stair-cases-Example 1	Design recommendations as per IS 456:2000
S-2	SLO-1	RC DESIGN: Partial safety factors -Limit state method-advantages	RC SLABS Design of continuous slabs-Example 1	RC BEAMS Design of singly reinforced beams-Example 1	RC STAIR-CASES Design of stair-cases-Example 2	RC FOUNDATIONS Design of isolated foundation-axially loaded-sloped
	SLO-2	General design recommendations as per IS 456:2000	Design of continuous slabs-Example 2	Design of singly reinforced beams-Example 2	Reinforcement detailing-Use of SP 34	Design of isolated foundation-axially loaded-stepped

S-3	SLO-1	*INTRODUCTION TO STEEL DESIGN AND PLASTIC ANALYSIS: Types of steel structures - Properties of structural steel, Indian Standard Specifications and sections- Design criteria as per IS 800:2007-Analysis methods*	*STEEL TENSION MEMBERS Design provisions of tension members*	*STEEL COMPRESSION MEMBERS Design of simple columns-Procedure*	*STEEL CONNECTIONS Design of pin connections*	*STEEL BEAMS Design provisions of beams*
	SLO-2	*Calculation of Loads as per IS codes- Design Philosophy-Introduction to Limit State Method of design – Partial safety factors- General design requirements as per IS800:2007*	*Design of simple tension members - Effective net area-Types of failures*	*Design of simple columns-Example 1*	*Design of lap joints-Procedure*	*Design of simple beams-restrained-Procedure*
S-4	SLO-1	*PLASTIC ANALYSIS :Plastic analysis, Plastic hinge mechanism, Plastic moment of resistance, Plastic modulus*	*STEEL TENSION MEMBERS Design of plates with holes subjected to tension-Procedure*	*STEEL COMPRESSION MEMBERS Design of simple columns-Example 2*	*STEEL CONNECTIONS Design of lap joints-Example 1*	*STEEL BEAMS Design of simple beams-restrained-Example*
	SLO-2	*Shape Factor for rectangular, circular and triangular sections*	*Design of plates with holes subjected to tension-Example*	*Types of built up columns*	*Design of lap joints-Example 2*	*Lateral torsional buckling behaviour of unrestrained beams*
S-5	SLO-1	*RC DESIGN :Behaviour of RC sections under flexure, stress blocks – IS, AC and BS*	*RC SLABS Reinforcement detailing of continuous slabs*	*RC BEAMS Design of doubly reinforced beams-Procedure*	*RC COLUMNS Short and long columns, Effective length slenderness ratio, un braced and braced columns -Design recommendations as per IS 456:2000*	*RC FOUNDATIONS Design of isolated foundation-eccentrically loaded-Procedure*
	SLO-2	*Behaviour of RC sections under shear*	*Design of two way slabs-Procedure*	*Design of doubly reinforced beams-Example 1*	*Design of axially loaded short columns*	*Design of isolated foundation-eccentrically loaded-Example*
S-6	SLO-1	*RC DESIGN :Design recommendations as per IS 456:2000-flexure*	*RC SLABS Design of two way slabs-Simply supported on the edges with corners not held down*	*RC BEAMS Design of doubly reinforced beams-Example 2*	*RC COLUMNS Uniaxial and biaxial bending of columns*	*RC FOUNDATIONS Design of combined rectangular foundation-Procedure*
	SLO-2	*Design recommendations as per IS 456:2000-shear*	*Design of two way slab- Simply supported on the edges with corners held down*	*Ductile detailing of beams as per IS 13920*	*Use of interaction curves from SP16*	*Design of combined rectangular foundation-Example*
S-7	SLO-1	*PLASTIC ANALYSIS: Shape Factor for I section*	*STEEL TENSION MEMBERS Design of angles subjected to tension-Procedure*	*STEEL COMPRESSION MEMBERS Design of lacing-Procedure*	*STEEL CONNECTIONS Design of butt joints-Procedure*	*STEEL BEAMS Check for lateral torsional buckling of unrestrained beams-Steps*
	SLO-2	*Shape Factor for T and C sections*	*Design of angles subjected to tension-Example*	*Design of lacing-Example*	*Design of butt joints-Example 1*	*Check for lateral torsional buckling of unrestrained beams-Example*
S-8	SLO-1	*PLASTIC ANALYSIS: Load factor, Static method of plastic analysis*	*STEEL TENSION MEMBERS Design of built-up tension members-various cross-sections*	*STEEL COMPRESSION MEMBERS Design of batten-Procedure*	*STEEL CONNECTIONS Design of butt joints-Example 2*	*STEEL BEAMS Design of beams subjected to biaxial bending-Procedure*
	SLO-2	*Mechanism method of plastic analysis*	*Design of built-up tension members-Procedure*	*Design of batten-Example*	*Design of Truss joint-Procedure*	*Design of beams subjected to biaxial bending-Example 1*
S-9	SLO-1	*RC SLABS Introduction-Types of slab -Introduction on moment co-efficient and design recommendations as per IS 456:2000*	*RC SLABS Design of two way slabs-with edges fixed*	*RC BEAMS Design of flanged beams-Procedure*	*RC COLUMNS Design of long columns*	*RC FOUNDATIONS Introduction to Strip Footing*
	SLO-2	*Design of one way slabs-Procedure*	*Design of two way slabs-Example*	*Design of flanged beams-design for torsion*	*Ductile detailing of columns as per IS 13920*	*Introduction to Raft Footing*

S-10	SLO-1	*RC SLABS* *Design of one way slabs-Example 1*	*RC SLABS* *Reinforcement detailing of two way slabs*	*RC BEAMS* *Design of flanged beams-Example 1*	*RC COLUMNS* *Reinforcement detailing at beam-column joints using SP34*	*RC FOUNDATIONS* *Design of pile foundation, pile cap*
	SLO-2	*Design of one way slabs-Example 2*	*Use of design handbooks*	*Design of flanged beams-Example 2*	*Extension of design of columns to piles*	*Reinforcement detailing*
S-11	SLO-1	*PLASTIC ANALYSIS :Analysis of indeterminate beams with uniform M_p*	*STEEL TENSION MEMBERS* *Design of built-up tension members-Example*	*STEEL CONNECTIONS* *Types of connections-Bolted and welded*	*STEEL CONNECTIONS* *Design of Truss joint-Example 1*	*STEEL BEAMS* *Design of beams subjected to biaxial bending-Example 2*
	SLO-2	*Analysis of indeterminate beams with varying M_p*	*Tension splices*	*Types of bolts and welds-Permissible stresses*	*Design of Truss joint-Example 2*	*Design of built-up beams-Procedure*
S-12	SLO-1	*PLASTIC ANALYSIS :Analysis of single bay single storey rectangular portal frames-with same column heights*	*STEEL COMPRESSION MEMBERS* *Design provisions of compression members*	*STEEL CONNECTIONS* *Load transfer mechanism*	*STEEL BEAMS* *Behaviour of steel members in flexure*	*STEEL BEAMS* *Design of built-up beams-Example 1*
	SLO-2	*Analysis of single bay single storey rectangular portal frames with varying column heights*	*Effective length-Slenderness ratio-Types of buckling-Classification of cross-sections*	*Types of failure of connections*	*Phenomenon of web buckling and web crippling*	*Design of built-up beams-Example 2*

Learning Resources	1. *Varghese.P.C, Limit State Design of Reinforced Concrete, 2nd ed.,PHI Learning Pvt. Ltd., 2004* 2. *Unnikrishna Pillai.S, Devdoss Menon, Reinforced Concrete Design, 5th ed., Tata McGraw, 2003* 3. *Subramanian.N, Design of Reinforced Concrete Structures, Oxford University Press, 2013* 4. *Punmia.B.C, Ashok Kumar Jain,A run Kumar Jain, Limit State Design of Reinforced Concrete,1st edition, Laxmi Publications Pvt. Ltd., 2007* 5. *Duggal S.K, Limit state design of steel structures, Tata McGraw Hill, 2010*	6. *Subramanian.N, Design of Steel structures-Limit state method, Oxford University Press, 2016* 7. *Shah.V.L., Veena Gore, Limit State Design of. Steel Structures, 1st ed.,Structures Publications, 2009* 8. *Punmia.B.C, Ashok Kumar Jain, Arun Kumar Jain,Comprehensive Design of Steel structures, Laxmi Publications Pvt. Ltd., 2007* 9. *NPTELCourse: Design of Reinforced Concrete Structures: https://onlinecourses.nptel.ac.in/noc18_ce24/preview* 10. *NPTELCourse: Design of Steel Structures https://onlinecourses.nptel.ac.in/noc17_ce21/preview*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. C. Uma Rani, Professor, Anna University, umarani@annauniv.edu*	*2. Prof. G. Augustine Maniraj Pandian, SRMIST*

Course Code	18CEC208T	Course Name	ENVIRONMENTAL ENGINEERING AND DESIGN	Course Category	C	*Professional Core*	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*18CEC208L*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Utilize the sources of water supply and its quality*
CLR-2 :	*Design and Construct water treatment for domestic supplies*
CLR-3 :	*Utilize sanitary engineering concepts for implementation*
CLR-4 :	*Design sewage treatment plants for towns and cities*
CLR-5 :	*Utilize solid waste management mechanisms*
CLR-6 :	*Analyze the role of Government and NGO's in sustaining the environment*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*Identify the various sources of water and its quality*	*2*	*85*	*80*	*H*	*H*	*M*	*L*	-	*L*	*H*	-	-	-	-	*L*	*H*	-	-
CLO-2 :	*Design water treatment units for domestic purposes*	*3*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*H*	-	-
CLO-3 :	*Identify the collection and conveyance of domestic sewage*	*2*	*80*	*75*	*H*	*H*	*M*	*M*	-	*L*	*H*	-	-	-	-	*L*	*H*	-	-
CLO-4 :	*Design of sewage treatment units for sanitary sewage*	*3*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*H*	-	-
CLO-5 :	*Apply the concept of reducing, reuse, recycling in solid waste management*	*2*	*85*	*80*	*H*	*H*	*M*	*M*	*L*	*L*	*M*	-	-	-	-	*L*	*H*	-	-
CLO-6 :	*Analyze the environmental legislations*	*2*	*80*	*75*	*H*	*H*	*M*	-	-	*L*	*M*	*M*	-	-	-	-	*H*	-	-

		Water Supply	Water Treatment	Sanitary Engineering	Disposal of Sewage	Solid Waste Management & Air Pollution
Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Water quality requirement for different beneficial uses*	*Concept and objectives of water treatment*	*Domestic and storm water quantity of sewage and flow variations*	*Concept of sewage disposal*	*Concept and generation of solid waste*
	SLO-2	*Importance of water supply scheme and Need for protected water supply*	*Principles of Aeration and Sedimentation. Types of sedimentation & design*	*Conveyance of sewage and types of sewers. Design of sewers*	*Pollution due to improper disposal of sewage*	*Municipal Solid Waste(MSW), composition and other parameters*
S-2	SLO-1	*Various sources of water available for supply*	*Principles of Coagulation and Flocculation*	*Pumping of sewage and sewer appurtenances*	*Zones of pollution and Self-purification of rivers*	*Quantification and Collection of MSW*
	SLO-2	*Per capita consumption-Demand*	*Types of coagulants used in water treatment*	*Laying and jointing of sewer lines*	*Oxygen sag curve. National river cleaning plans Dissolved Oxygen and BOD*	*Treatment and disposal of MSW*
S-3	SLO-1	*Solving problems using Tutorial Sheet 1*	*Solving problems using Tutorial Sheet 4*	*Solving problems using Tutorial Sheet 7*	*Solving problems using Tutorial Sheet 10*	*Solving problems using Tutorial Sheet 13*
	SLO-2	*Solving problems using Tutorial Sheet 1*	*Solving problems using Tutorial Sheet 4*	*Solving problems using Tutorial Sheet 7*	*Solving problems using Tutorial Sheet 10*	*Solving problems using Tutorial Sheet 13*
S-4	SLO-1	*Quality issues in various sources of water*	*Concept and theory of Filtration*	*Different plumbing systems adopted in buildings*	*Disposal of treated sewage in irrigation land*	*Waste from commercial establishments and other urban areas*
	SLO-2	*Water Pollution, sources, causes and effects. Water quality characteristics*	*Working principles of slow sand filters and design*	*Sanitary fittings used in buildings. Quantification of storm water*	*Sewage sickness and remedial measures*	*Effect of solid waste on environment*
S-5	SLO-1	*WHO and BIS standards and Water Borne Diseases*	*Working principles of rapid sand filters and design*	*Concept of Primary, Secondary and Tertiary treatments*	*Concept of sludge management*	*Segregation and disposal methods of sloid waste*

	SLO-2	*Population forecast using different methods*	*Disinfection of water and Chlorination*	*Screening and Grit Chambers*	*Thickening, Conditioning and Dewatering of sludge*	*Reduction at source, recovery and recycle*
S-6	SLO-1	*Solving problems using Tutorial Sheet 2*	*Solving problems using Tutorial Sheet 5*	*Solving problems using Tutorial Sheet 8*	*Solving problems using Tutorial Sheet 11*	*Solving problems using Tutorial Sheet 14*
	SLO-2	*Solving problems using Tutorial Sheet 2*	*Solving problems using Tutorial Sheet 5*	*Solving problems using Tutorial Sheet 8*	*Solving problems using Tutorial Sheet 11*	*Solving problems using Tutorial Sheet 14*
S-7	SLO-1	*Water requirements for industrial need and agriculture*	*Advanced treatment like adsorption, ion exchange*	*Concept of aerobic and anaerobic treatment systems*	*Various disposal methods of sludge*	*Concept of Air Pollution: Properties and monitoring of Air pollutants*
	SLO-2	*Components of water supply system*	*Advanced treatment like membrane processes and UV methods.*	*Primary settling tanks and secondary settling tanks*	*Energy recovered from sludge*	*Air quality standards and control measures for Air Pollution*
S-8	SLO-1	*Transmission of water and distribution system*	*Effective water management Rain water harvesting methods*	*Principles of septic tanks and design.*	*Revenue from end product of sludge management*	*Basic concept of Noise Pollution and measurements*
	SLO-2	*Service reservoirs used in water supply*	*Measures taken for protecting the existing water bodies*	*Activated Sludge Process and Trickling Filters*	*Design of Sludge digestion tanks*	*Various control methods of noise pollution Acceptable standards for Noise levels*
S-9	SLO-1	*Solving problems using Tutorial Sheet 3*	*Solving problems using Tutorial Sheet 6*	*Solving problems using Tutorial Sheet 9*	*Solving problems using Tutorial Sheet 12*	*Solving problems using Tutorial Sheet 15*
	SLO-2	*Solving problems using Tutorial Sheet 3*	*Solving problems using Tutorial Sheet 6*	*Solving problems using Tutorial Sheet 9*	*Solving problems using Tutorial Sheet 12*	*Solving problems using Tutorial Sheet 15*

Learning Resources	1. *Metcalf, Eddy, Wastewater Engineering, Treatment and Reuse, Tata McGraw Hill, 2005* 2. *S. K. Garg, Water Supply Engineering, Khanna Publishers, 2017* 3. *S. K. Garg, Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2017* 4. *CPHEEO Manual on Water Supply and Treatment, Ministry of Drinking water and Sanitation, New Delhi, 2015*	5. *GeorgeTchobanoglous, Hilary Theisen, Samuel Vigil, Integrated Solid Waste Management, McGraw Hill,1993* 6. *CPHEEO Manual on Sewerage and Sewage Treatment, Ministry of Urban Development, New Delhi, 2010* 7. *NPTEL Course-Water, Society & Sustainability. https://onlinecourses.nptel.ac.in/noc18_hs36/* 8. *NPTEL Course-Wastewater Treatment & Recycling https://onlinecourses.nptel.ac.in/noc18_ce26*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai, rajkumar@hecs.in	*1. Dr. S. Madhava Kumar, IIT Madras, mathav@iitm.ac.in*	*1. Mr. K. Prasanna, SRMSIT*
2. Mr. A. Abdul Rasheed, CMWSS Board, juruterarasheed@gmail.com	*2. Dr. G. Dhinagaran, Anna University, Chennai, dhinagaran@annauniv.edu*	*2. Mr. D. Justus Reymond, SRMIST*

Course Code	18CEC208L	Course Name	ENVIRONMENTAL ENGINEERING LABORATORY	Course Category	C	Professional Core	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	18CEC208T	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Evaluate characteristics of water
CLR-2 :	Evaluate the characteristics of waste water
CLR-3 :	Conduct tests on water and wastewater
CLR-4 :	Utilize turbidity meter, pH meter, electrical conductivity meter
CLR-5 :	Utilize spectrophotometer, high volume sampler, noise level meter
CLR-6 :	Conduct titration experiments

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	Learning 2 Expected Proficiency (%)	Learning 3 Expected Attainment (%)	PLO 1 Engineering Knowledge	PLO 2 Problem Analysis	PLO 3 Design & Development	PLO 4 Analysis, Design, Research	PLO 5 Modern Tool Usage	PLO 6 Society & Culture	PLO 7 Environment & Sustainability	PLO 8 Ethics	PLO 9 Individual & Team Work	PLO 10 Communication	PLO 11 Project Mgt. & Finance	PLO 12 Life Long Learning	PLO 13 PSO - 1	PLO 14 PSO - 2	PLO 15 PSO - 3
CLO-1 :	Evaluate the characteristics of water	3	90	85	H	M	-	-	-	-	H	-	-	-	-	-	H	-	H
CLO-2 :	Analyze the characteristics of waste water	3	85	80	H	M	-	-	-	-	H	-	-	-	-	-	H	-	H
CLO-3 :	Test water and wastewater sample	3	90	85	H	M	-	-	-	-	-	-	-	-	-	-	H	-	H
CLO-4 :	Identify the working of turbidity meter, pHmeter, electrical conductivity meter	3	85	80	H	M	-	-	-	-	-	-	-	-	-	-	H	-	H
CLO-5 :	Identify the working of spectrophotometer, high volume sampler, noise level meter	3	85	80	H	M	-	-	-	-	H	-	-	-	-	-	H	-	H
CLO-6 :	Conduct titration based experiments	3	85	80	H	M	-	-	-	-	H	-	-	-	-	-	H	-	H

Duration (hour)		6	6	6	6	6
S 1-2	SLO-1	Determine turbidity, electrical conductivity, pH	Determine solids contents in water: Total, volatile, fixed, suspended, dissolved, settle able and inorganic solids	Determine alkalinity and Acidity	Determine total hardness, calcium and magnesium hardness	Determine chloride and sulphate
	SLO-2					
S 3-4	SLO-1	Determine optimum coagulant dose	Determine Chemical Oxygen Demand (COD)	Determine Dissolved Oxygen(DO) and Biological Oxygen Demand(BOD)	Determine break point chlorination	Determine copper
	SLO-2					
S 5-6	SLO-1	Determine bacteriological quality measurement: MPN	Monitor Ambient air quality (TSP,RSPM)	Monitor Ambient air quality (So_x)	Monitor Ambient air quality (NO_x)	Measure Ambient noise
	SLO-2					

Learning Resources	1. S. K. Garg, Water Supply Engineering, Khanna Publishers, 2017 2. S. K. Garg, Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2017	3. IS:10500-2012, Indian Standards for Drinking Water, Bureau of Indian Standards, New Delhi. 4. Environmental Engineering lab manual, SRMIST

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Understand										
Level 2	Apply	-	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Mr. A. Abdul Rasheed, CMWSS Board, juruterarasheed@gmail.com	*2. Dr .G. Dhinagaran, Anna University, Chennai, dhinagaran@annauniv.edu*	*2. Mr. S. Ramesh, SRMIST*

Course Code	18CEC301T	Course Name	HYDROLOGY AND WATER RESOURCES ENGINEERING	Course Category	C	Professional Core	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*18CEE311T, 18CEE312T, 18CEE313T*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Provide knowledge on various processes in the hydrologic cycle*
CLR-2 :	*Address the occurrence, movement and augmentation of groundwater*
CLR-3 :	*Provide deep understanding of various impounding and diversion structures*
CLR-4 :	*Create insights on the importance and characteristics of rivers and reservoirs*
CLR-5 :	*Address concepts related to necessity of irrigation, methods of applying water to the fields and evapotranspiration*
CLR-6 :	*Introduce various hydraulic structures and exploit their practical importance*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Understand the interaction among various processes in the hydrologic cycle*	*2*	*85*	*80*	*H*	*H*	*M*	*M*	-	-	*M*	-	-	-	-	-	*H*	-	-
CLO-2 :	*Intellectualize the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	*M*	-	-	-	-	-	*H*	-	-
CLO-3 :	*Understand the importance, features and uses of diversion and impounding structures*	*3*	*80*	*75*	*H*	-	-	-	-	-	*M*	-	-	-	-	-	*H*	-	-
CLO-4 :	*Perceive the importance of rivers, reservoirs and silt control*	*2*	*85*	*80*	*H*	-	-	-	-	-	*M*	-	-	-	-	-	*H*	-	-
CLO-5 :	*Understand the basics of irrigation, soil-water relationships and consumptive use*	*2*	*85*	*75*	*H*	*H*	*M*	*M*	-	-	*M*	-	-	-	-	-	*H*	-	-
CLO-6 :	*Identify the functions and importance of various hydraulic structures*	*3*	*80*	*75*	*H*	*H*	-	-	-	-	*M*	-	-	-	-	-	*H*	-	-

Duration (hour)		SURFACE WATER HYDROLOGY	GROUND WATER HYDROLOGY	DIVERSION AND IMPOUNDING STRUCTURES	RIVERS AND RESERVOIRS	IRRIGATION AND DISTRIBUTION SYSTEMS
		12	12	12	12	12
S-1	SLO-1	*Introduction, hydrologic cycle*	*Occurrence of ground water, porosity*	*Weirs and barrages*	*Rivers: types and characteristics*	*Irrigation, necessity, advantages and disadvantages*
	SLO-2	*World water balance, applications in engineering*	*Permeability and transmissibility*	*Gravity and non-gravity weirs*	*Classification based on the basis of the topography of the river basin*	*Methods of applying water to the fields*
S-2	SLO-1	*Precipitation, forms and types*	*Zones of subsurface water*	*Diversion head works and its components*	*Classification based on the basis of flood hydrographs*	*Surface, subsurface, sprinkler and drip irrigation*
	SLO-2	*Measurement of precipitation, rain gauge network*	*Movement of groundwater, Darcy's law*	*Functions of weir proper, under sluices, divide wall, fish ladder and canal head regulator*	*Indian rivers and their classification*	*Soil-water-plant relationship*
S-3	SLO-1	*Mean areal depth of precipitation, arithmetic average method*	*Specific yield and specific retention*	*Failure of hydraulic structures*	*Behaviour of rivers: straight reaches, bends and meanders*	*Hygroscopic water, capillary water and gravitational water*
	SLO-2	*Thiessen polygon method and isohyetal method*	*Aquifers and their types*	*Failure by piping and failure by direct uplift*	*Causes of meandering, cutoff*	*Field capacity, permanent wilting point, available moisture, readily available moisture*
S-4	SLO-1	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*
	SLO-2	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*

Duration (hour)		SURFACE WATER HYDROLOGY	GROUND WATER HYDROLOGY	DIVERSION AND IMPOUNDING STRUCTURES	RIVERS AND RESERVOIRS	IRRIGATION AND DISTRIBUTION SYSTEMS
		12	12	12	12	12
S-5	SLO-1	*Estimation of missing precipitation*	*Specific capacity and coefficient of storage*	*Bligh's creep theory*	*River training: objectives and classification*	*Depth of water stored in root zone*
	SLO-2	*Optimum raingauge network design*	*Infiltration wells and infiltration galleries*	*Lane's weighted creep theory*	*Types of training works*	*Limiting soil moisture conditions, depth and frequency of irrigation*
S-6	SLO-1	*Probable Maximum Precipitation*	*Open wells and tube wells*	*Khosla's theory*	*Levees, guide banks*	*Crop season, duty and delta*
	SLO-2	*Runoff process, components of stream flow*	*Types of tube wells*	*Khosla's method of independent variables for determination of pressures and exit gradient for seepage below a weir or a barrage*	*Artificial cutoff and pitched island*	*Factors affecting duty and method of improving duty*
S-7	SLO-1	*Factors affecting runoff*	*Yield of an open well, pumping test*	*Design of pucca floor and aprons*	*Groynes: types – normal, attracting and deflecting*	*Consumptive use: estimation by Blaney Criddle method and pan evaporation method*
	SLO-2	*Estimation of runoff, empirical formulae*	*Recuperation test*	*Design of pucca floor and aprons*	*Reservoir: types*	*Canal: types of alignment*
S-8	SLO-1	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*
	SLO-2	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*
S-9	SLO-1	*Infiltration method*	*Steady state flow in wells*	*Dams, function and uses, classification*	*Suitable site for a reservoir and storage zones*	*Distribution systems, channel losses*
	SLO-2	*SCS-CN method of estimating runoff volume*	*Dupuit's equilibrium equation for confined and unconfined aquifers*	*Factors governing the selection of a particular type of dam*	*Storage-discharge relation of a reservoir*	*Design of channels: rigid boundary channels and alluvial channels*
S-10	SLO-1	*Flow duration curve*	*Theim's equation for confined aquifer*	*Selection of dam site, problems in dam construction*	*Reservoir yield, safe yield, design yield, secondary yield and average yield*	*Kennedy's and Lacey's theories of regime channels*
	SLO-2	*Flow mass curve*	*Theim's equation for unconfined aquifer*	*Gravity dams: forces on gravity dams*	*Mass curve and demand curve*	*Water logging: causes, effects and remedial measures*
S-11	SLO-1	*Hydrograph, components of hydrograph*	*Spacing of wells*	*Modes of failure, construction of gravity dams*	*Designing reservoir capacity for a given yield and designing yield from a reservoir of a given capacity*	*Functions and uses of canal regulator and cross regulator*
	SLO-2	*Environmental flows*	*Artificial recharge methods*	*Galleries: functions and types. Earthen dam: types and causes of failure*	*Reservoir sedimentation: pre and post control measures, economic height of dam*	*Functions and uses of canal fall, canal escape and cross drainage works*
S -12	SLO-1	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*
	SLO-2	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*	*Tutorial*

Learning Resources	
	1. *Santosh Kumar Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publication, New Delhi, 2000.* 2. *Subramanya, K., Engineering Hydrology, Tata Mc-Graw Hill* 3. *Asawa, G.L.., Irrigation Engineering, Wiley Eastern* 4. *Ven Te Chow, David R. Maidment and Larry W. Mays, Applied Hydrology, McGraw-Hill Book Company*
	5. *Raghunath, H.M., Hydrology, New Age International Publishers, New Delhi, 2007.* 6. *Sharma, R.K., Irrigation Engineering and Hydraulic Structures, Oxford and IBH Publishing Company, New Delhi* 7. *Punmia, B.C., and Pande, B.B., Irrigation and Water Power Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 2009* 8. *8..NPTEL Course: Water Resources Engineering: https://nptel.ac.in/downloads/105105110/#,*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Abdul Hakeem, National Remote Sensing Center, Hyderabad, abdulhakeem_k@nrsc.gov.in	*1. Dr. Rehana Shaik, IIIT, Hyderabad, rehana.s@iiit.ac.in*	*1. Dr. R. Sathyanathan, SRMIST*
2. Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru, sat@satyukt.com	*2. Dr. S. Saravanan, NIT Trichy, saravanans@nitt.edu*	*2. Dr. Deeptha Thattai, SRMIST*

Course Code	18CEC302T	Course Name	GEOTECHNICAL ENGINEERING	Course Category	C	Professional Core	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Create insights in to different properties of soil*
CLR-2 :	*Deal with the classification and identification of soil*
CLR-3 :	*Understand concept of permeability and seepage of soils*
CLR-4 :	*Analyse the consolidation and compaction effect on soil in lab and field*
CLR-5 :	*Analyse the principles of effective stress in saturated soils, various soil condition the shear strength of the soils*
CLR-6 :	*Utilize the concept of various soil condition and shear strength of the soils in real time applications*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify the various properties of soil*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Analyse the classification of soil*	*2*	*85*	*75*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Identify permeability and seepage of soils*	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-4 :	*Identify the consolidation and compaction effect on soil in lab and field*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-5 :	*Apply the principles of effective stress in saturated soils, various soil condition the shear strength of the soils*	*2*	*85*	*80*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-6 :	*Analyse the concept of various soil condition and shear strength of the soils in real time applications*	*2*	*80*	*75*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-

Duration (hour)		09	09	09	09	09
S-1	SLO-1	*Introduction-Definitions: soils*	*Particle size distribution*	*Permeability of Soil-importance*	*Compaction of Soil*	*Introduction- Stresses in soils*
	SLO-2	*Soil mechanics*	*Sieve analysis - problem*	*Introduction to hydraulic head*	*Introduction, theory of compaction,*	*Geostatic stress*
S-2	SLO-1	*Scope of Geotechnical engineering,*	*Plasticity Characteristics of soil*	*Darcy's law - Assumptions.*	*Laboratory determination of optimum moisture content and maximum dry density*	*Total - Effective and Neutral stress,*
	SLO-2	*Basic Definitions and Relationships-*	*Introduction to definitions of: plasticity of soil*	*Determination of coefficient of permeability*	*Standard Proctor test and Modified Proctor test – Problems in compaction*	*Fluctuations of effective stress*
S-3	SLO-1	*Two and three phase system of soil*	*Consistency limits-liquid limit, plastic limit*	*Laboratory method: Constant head method problems*	*Compactive energy –Factors affecting compaction*	*Effective stress in soils saturated by capillary action,*
	SLO-2	*Relationships in terms of weightand volume in phase system – moisture content*	*Shrinkage limit, Determination of: liquid limit*	*Coefficient of permeability*	*CBR of soil – procedure - problem*	*Problems in Geostatic stress – soil condition*
S-4	SLO-1	*Definitions: degree of saturation, void ratio, porosity*	*Determination of plastic limit and shrinkage limit.*	*Falling head method - problems*	*Field compaction methods*	*Problems in Geostatic stress – water table effect*
	SLO-2	*specific gravity, unit weights*	*Indices: Plasticity, liquidity and consistency, flow and toughness*	*Field method: types*	*Factors affecting field compaction*	*Shear Strength- Lab and filed methods*
S-5	SLO-1	*Relationship between bulk and dry density , void ratio- porosity, void ratio*	*Definition: Activity and sensitivity.*	*Pumping-out test – Confined aquifer*	*Consolidation of Soil*	*Shear test: direct shear test*
	SLO-2	*Water content- specific gravity-degree of saturation*	*Classification of Soils*	*Field method - Unconfined aquifer*	*Introduction, comparison between compaction and consolidation,*	*Shear test: merits and demerits - problem*

Duration (hour)		09	09	09	09	09
S6	SLO-1	*Unit weights - specific gravity - void ratio – degree of saturation –*	*Introduction of soil classification system*	*problems in field methods*	*Initial, primary consolidation*	*Unconfined compression test - problem*
	SLO-2	*Moisture content determination – Methods, Determination by oven dry method*	*methods:- particle size classification*	*Permeability in stratified soils*	*Secondary consolidation*	*Triaxial compression tests.*
S-7	SLO-1	*Problems in two phase system.*	*Indian standard soil classification system*	*Flow parallel and perpendicular to bedding plane - problems*	*Spring analogy for primary consolidation,*	*Drainage conditions*
	SLO-2	*Problems in three phase system.*	*Indian Soil classification system cohesive soil, cohesionless soil.*	*Factors affecting permeability of soil*	*Terzaghi's theory of one dimensional consolidation*	*Merits and demerits*
S-8	SLO-1	*Specific gravity – methods,*	*Indian Soil classification system –- Problems*	*Quick sand condition - Seepage Analysis*	*Partial differential equations (no analytical)*	*Drainage conditions- problem*
	SLO-2	*Determination by density bottle method and pycnometer method*	*Problems in BIS system*	*Introduction- seepage pressure.*	*Laboratory tests-*	*Relation between major and minor principal stresses*
S-9	SLO-1	*Field density methods – Determination by core cutter method*	*Soil identification*	*Characteristics of flow nets*	*Determination of coefficient of consolidation*	*Vane shear test. – problem*
	SLO-2	*Sand replacement method.*	*Field identification of soils.*	*Uses and application of flow nets.*	*√t andLog t methods.*	*Factors affecting shear strength*

Learning Resources	1. *Raju .K.V.B .and Ravichandran .P.T, "Mechanics of Soils", Ayyappaa Publications, 2000.* 2. *Punmia B.C., Soil Mechanics and Foundations, Laxmi Publications Pvt. Ltd., 2000* 3. *Arora .K.R, "Soil Mechanics and Foundation Engineering", Standard Publication Distributors, 2011.* 4. *Gopal Ranjan, Rao.A.S.R., Basic and Applied Soil Mechanics, Wiley Eastern Ltd., 2000* 5. *Terzaghi K., Peck R.B., Soil Mechanics in Engineering Practice, John Wiley Ltd., 1967* 6. *Lambe T.W., Whitman, Soil Mechanics, John Wiley Ltd., 1979.* 7. *NPTEL Course - Soil Mechanics / Geotechnical Engineering1 : https://nptel.ac.in/courses/105105168/* 8. *8. NPTEL Course - Concepts in Geotechnical and Foundation Engineering : https://nptel.ac.in/courses/105106142/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
Level 2	Apply Analyze	*30%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
Level 3	Evaluate Create	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 : Assignments and / or Multiple choice Quizzes

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *Dr. P.Selvanambi, Divisional Engineer (Highways), sundariselvam@yahoo.com*	1. *Dr.M.Muttharam, Anna University, muttharam@annauniv.edu*	1. *Dr. P.T. Ravichandran, SRMIST*
2. *Mr.Lenin K.R., Head –GEOTECH, SECON Private Limited, Bangalore, lenin.kr@secon.in*	2. *Dr.V.Murugaiyan, Pondichery Engineering College, vmurugaiyan@pec.edu*	2. *Ms.Divya Krishnan K, SRMIST*

Course Code	18CEC302L	Course Name	GEOTECHNICAL ENGINEERING LABORATORY	Course Category	C	Professional Core	L	T	P	C
							0	0	2	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*		Data Book / Codes/Standards	*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Determine the engineering and index properties of soils*
CLR-2 :	*Determine the compaction and CBR value of soil*
CLR-3 :	*Impart knowledge on permeability characteristics of soil*
CLR-4 :	*Determine the filed density of soil*
CLR-5 :	*Determine the shear strength of soil*
CLR-6 :	*Study the working principle and function of triaxial shear test*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify the use of sieve, Atterberg's apparatus in determination of soil properties.*	*2*	*90*	*85*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-	*M*	-	*H*
CLO-2 :	*Estimate the OMC and Density to compact and CBR value of soil*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-	*M*	-	*H*
CLO-3 :	*Analyse the permeability characteristics of various soil.*	*2*	*90*	*85*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-	*M*	-	*H*
CLO-4 :	*Measure the density of soil in-situ*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-	*M*	-	*H*
CLO-5 :	*Evalute the shear strength of soil*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-	*M*	-	*H*
CLO-6 :	*Understand the working principle and use of triaxial shear test*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-	*M*	-	*H*

Duration (hour)		6	6	6	6	6
S 1-2	SLO-1	*Moisture content using oven drying method*	*Consistency limits - Liquid limit, Plastic limit and Shrinkage limit.*	*Compaction test - Standard Proctor method*	*California Bearing Ratio of soil*	*Direct shear test*
	SLO-2					
S 3-4	SLO-1	*Specific gravity of soil grains*	*Permeability - Constant head method.*	*Field density - Core cutter method and Sand replacement method*	*Unconfined compression strength test*	*Triaxial shear test*
	SLO-2					
S 5-6	SLO-1	*Grain size distribution by sieve analysis*	*Permeability - Falling head method*	*Relative density of cohesion less soil*	*Free swell index test*	*Vane shear test*
	SLO-2					

Learning Resources	*1. Raju .K.V.B .and Ravichandran .P.T, "Mechanics of Soils", Ayyappaa Publications, 2000.* *2. Punmia B.C., Soil Mechanics and Foundations, Laxmi Publications Pvt. Ltd., 2000* *3. Laboratory Manual for Soil Mechanics Laboratory, SRMIST*	*4. Terzaghi K., Peck R.B., Soil Mechanics in Engineering Practice, John Wiley Ltd., 1967* *5. NPTEL course – Geotechnical Engineering Laboratory : https://nptel.ac.in/courses/105101160/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Understand										
Level 2	Apply	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from Record and Model Examination.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *Dr. P.Selvanambi, Divisional Engineer (Highways), sundariselvam@yahoo.com*	1. *Dr.M.Muttharam, Anna University, muttharam@annauniv.edu*	1. *Ms.S. Mary Rebekah Sharmila, SRMIST.*
2. *Mr.Lenin K.R., Head –GEOTECH, SECON Private Limited, Bangalore, lenin.kr@secon.in*	2. *Dr.V.Murugaiyan, Pondichery Engineering College, vmurugaiyan@pec.edu*	2. *Ms.Divya Krishnan K, SRMIST*

Course Code	18CEC303T	Course Name	HIGHWAY ENGINEERING AND DESIGN	Course Category	C	Professional Core Course	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Understand the concepts in the geometric design of highway*			
CLR-2 :	*Learn the needs and concepts in horizontal and vertical alignment of highway*			
CLR-3 :	*Learn various traffic studies required for traffic management*			
CLR-4 :	*Learn the design of various infrastructure facilities required for the traffic*			
CLR-5 :	*Understand the material requirement of flexible pavement and design the pavement*			
CLR-6 :	*Understand the components of rigid pavement and its design*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Design the geometric cross-section of highway*	*2*	*85*	*80*	*H*	*H*	*M*	*H*	-	-	*M*	-	-	-	-	-	*M*	-	-
CLO-2 :	*Design the horizontal and vertical alignment of highway*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*M*	-	-	-	-	-	*M*	-	-
CLO-3 :	*Conduct various traffic studies and analysis the volume and speed data*	*2*	*80*	*75*	*M*	*H*	*L*	*L*	-	-	*M*	-	-	-	-	-	*M*	-	-
CLO-4 :	*Plan and design the various infrastructure facilities required for the traffic*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-5 :	*Execute the material and the structural design of flexible pavement*	*2*	*85*	*80*	*H*	*H*	*M*	*H*	-	-	*M*	-	-	-	-	-	*M*	-	-
CLO-6 :	*Execute the material and the structural design of flexible pavement*	*2*	*80*	*75*	*H*	*H*	*M*	*H*	-	-	*M*	-	-	-	-	-	*M*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Highway Geometric Design Elements of transportation Engineering*	*Extra widening and numerical examples*	*Traffic Facilities Design Traffic signs and*	*Flexible Pavement Component of Flexible pavement*	*Rigid Pavement Components of Rigid pavement*
	SLO-2	*Overviewof the course*	*Method of attaining superelevation in curves*	*Road markings*	*Functions of each component*	*Components of Rigid pavement – Details of joints*
S-2	SLO-1	*Highway planning and Alignment*	*Set back distance and shift in curves with numerical examples*	*Channelization of traffic*	*Materials - Basic properties of bitumen*	*Stresses in Rigid pavement – Temperature stress*
	SLO-2	*Classification of rural and urban roads*	*Reverse curve and compound curve*	*Channelization layouts*	*Binder grade and classification*	*Stresses in Rigid pavement – Temperature stress – numerical examples*
S-3	SLO-1	*Cross sectional elements of roads*	*Design of vertical alignment – summit curve*	*Traffic rotary - design elements capacity of rotary*	*Materials – Soil and aggregate properties*	*Stresses in Rigid pavement – Wheel load stress*
	SLO-2	*Terrain classification and speed and geometric standards for different terrain*	*Design of vertical alignment – summit curve – numerical example*	*Capacity ofrotary*	*Resilient modulus of aggregate and soil*	*Stresses in Rigid pavement – Wheel load stress – Numerical examples*
S-4	SLO-1	*Sight Distance – Stopping sight distance – Concept and derivations*	*Design of vertical alignment – valley curve*	*Rotary design - Numerical Example*	*Materials – Bituminous concrete mix properties*	*Stress combinations and critical stress*
	SLO-2	*Stopping sight distance – Numerical examples*	*Design of vertical alignment – valley curve – Numerical example*	*Rotary design - Numerical Example*	*Materials – Types of bituminous concrete mix*	*Thickness of Rigid pavement*

Duration (hour)		9	9	9	9	9
S-5	SLO-1	*Overtaking sight distance – assumptions and derivations*	*Traffic studies Fundamental traffic parameters - speed, density, volume, travel time*	*Grade separated intersection – Warrants and types*	*Bituminous concrete mix design*	*Design of Joint spacing*
	SLO-2	*Overtaking sight distance – Numerical examples*	*Headway, and spacing -time mean speed, space mean speed – spot speed*	*Layout of grade separated intersection*	*Bituminous concrete mix design*	*Design of Joint spacing – Numerical examples*
S-6	SLO-1	*Overtaking sight distance – Numerical examples*	*Traffic volume study – need and procedure*	*Elementsof traffic signal - headway, saturation flow*	*Flexible pavement design factor – Traffic factor*	*Dowel bar design*
	SLO-2	*Intersection sightdistance*	*Traffic volume calculation and analysis*	*Design principles of a traffic signal – Phase design, cycle time determination, green splitting*	*Traffic– equivalent single wheel load and standard axle load*	*Design of dowel bars – Numerical examples*
S-7	SLO-1	*Horizontal curve – circular curve radius*	*Spotspeed study – need and procedure*	*Two phase signal design – Numerical example*	*Traffic factor - truck factor, vehicle damage factor,number of repetition of standard axle load*	*Check for the adequacy of dowel bars – Numerical example*
	SLO-2	*Super elevation and minimum ruling radius*	*Traffic speed analysis*	*Two phase signal design – Numerical example*	*Number of repetition of standard axle load – Numerical examples*	*Check for the adequacy of dowel bars – Numerical example*
S-8	SLO-1	*Determination of radius and super elevation – numerical example*	*Speed study – Moving observer method*	*Three phase signal design- with exclusive pedestrian phase – Numerical example -*	*Design of flexible pavement – determination of pavement thickness (with unbounded layers)*	*Design of tie bars*
	SLO-2	*Determination of radius and super elevation – numerical example*	*Moving observer method – numerical calculation*	*Three phase signal design- with exclusive pedestrian phase – Numerical example -*	*Design of flexible pavement – determination of pavement thickness (with unbounded layers)*	*Design of tie bars – numericalexamples*
S-9	SLO-1	*Transition curve – length – assumptions and derivations*	*Parking study and demand analysis*	*Signal co-ordination*	*Design of flexible pavement – determination of pavement thickness (with bonded layers)*	*Codal provisions and issues in current design methods*
	SLO-2	*Transition curve – length – Numerical examples*	*Data to be studied in accident spots*	*Signal co-ordination – determination of bandwidth*	*Design of flexible pavement – determination of pavement thickness (with bonded layers)*	*Codal provisions and issues in current design methods*

Learning Resources		
	1. *Chakroborthy and A. Das, "Principles of Transportation Engineering", Prentice-Hall of India, 2003* 2. *S. K. Khanna, C.E.G. Justo and A. Veeraragavan, "Highway Engineering", Revised 10th edition, Nem Chand &Bros., Roorkee, 2014.* 3. *Roess, R. P. McShane, W. R. & Prassas, E. S. (1998), Traffic Engineering, Prentice – Hall.*	4. *Papacostas, C. S. and Prevedouros, P.D. (2001) "Transportation Engineering and Planning", Prentice Hall of India Pvt. Ltd.* 5. *Kadiyali, L. R. (1987), "Traffic Engineering and Transportation Planning", Khanna Publishers, India.* 6. *Yang Huang, Pavement Analysis and Design, Pearson, 2004* 7. *NPTEL – Introduction to Transportation Engineering - https://nptel.ac.in/courses/105105107/ (as on 05.07.2019)*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of Assignments, Seminars, Tech Talks, Mini Projects, Case Studies, Self Study, MOOCs, Certifications, Conference Paper

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.com*	1. *Dr. Venkaiah Chowdary, Associate Professor, NITW, vc@nitw.ac.in*	1. *Dr.A.Padma Rekha, SRM IST*
2. *Mr. Ankit Pachouri, Transport Planner, IUT, New Delhi, ankit.pachouri@iutundia.org*	2. *Dr. V Sunitha, Assistant Professor, NITT, sunitha@nitt.edu*	2. *Mr.G.Sivaprakash, SRM IST*

Course Code	18CEC303L	Course Name	HIGHWAY ENGINEERING LABORATORY	Course Category	C	Professional Core Course	L	T	P	C
							0	0	2	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Learn to measure traffic volume count and categorize different mode of traffic at straight road and intersection*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	*Analyze the travel time and speed characteristics*			
CLR-3 :	*Study the parking characteristics*			
CLR-4 :	*Measure the properties of bitumen and aggregates*			
CLR-5 :	*Learn the proportioning of aggregate*			
CLR-6 :	*Measure the volumetric and strength of bituminous mixture*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Evaluate the vehicular composition in the straight road and intersection*	*3*	*90*	*85*
CLO-2 :	*Understand the travel time, delay and speed characteristics*	*3*	*85*	*80*
CLO-3 :	*Apply the effective parking systems*	*3*	*90*	*85*
CLO-4 :	*Grade the bitumen and select the aggregate for the preparation of bituminous mixture*	*3*	*85*	*80*
CLO-5 :	*Design the aggregate gradation for bituminous mixture*	*3*	*85*	*80*
CLO-6 :	*Design the bituminous mixture mix proportion*	*3*	*85*	*80*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	*M*		-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
H	*M*	-	-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
H	*M*	-	-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
H	*M*	-	-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
H	*M*	-	-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
H	*M*	-	-	-	-	-	-	*H*	-	-	-	*H*	-	*H*

Duration (hour)		6	6	6	6	6
S 1-2	SLO-1	*Determination of Vehicular composition in Straight moving traffic stream*	*Determination of traffic stream parameters by Moving Observer method*	*Determination of the penetration value of bitumen*	*Determination of ductility of bitumen*	*Batching of aggregates*
	SLO-2					
S 3-4	SLO-1	*Determination of Vehicular turning movement at any intersection*	*Evaluation of on street parking characteristics*	*Determination of softening point of bitumen*	*Determination of specific gravity of bitumen and aggregates*	*Preparation of bituminous mix and measure of mixture volumetric properties*
	SLO-2					
S 5-6	SLO-1	*Determination of instantaneous spot speed of vehicles*	*Evaluation of off street parking characteristics*	*Determination of viscosity of bitumen*	*Performance grading of bitumen - demo*	*Marshall stability test and design of bituminous mix*
	SLO-2					

Learning Resources		
	1. *S. K Khanna, C E G Justo, A Veeraraghavan, Highway Engineering,Nem Chand and Bros*	3. *IS 15462:2004, Polymer and Rubber Modified Bitumen - Specification, BIS, New Delhi*
	2. *IS 73 : 2013, Paving Bitumen - Specification, 4th Revision, BIS, New Delhi*	4. *MoRTH. Specification for roads and bridge work. Indian Roads Congress, New Delhi, India.*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Understand										
Level 2	Apply	-	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from Record and Model Examination.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.com	*1. Dr. VenkaiahChowdary, Associate Professor, NITW, vc@nitw.ac.in*	*1. Dr. A. Padma Rekha, SRM IST*
2. Mr. Ankit Pachouri, Transport Planner, IUT, New Delhi, ankit.pachouri@iutundia.org	*2. Dr. V Sunitha, Assistant Professor, NITT, sunitha@nitt.edu*	*2. Mr. G. Sivaprakash and Ms. R Dhanya, SRM IST*

Course Code	18CEC304T	Course Name	CONSTRUCTION ENGINEERING AND MANAGEMENT	Course Category	C	Professional Core Course	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Identify the characteristics of project and planning aspects*
CLR-2 :	*Solve the CPM and PERT problems and apply the concept of project planning*
CLR-3 :	*Identify the techniques of project controlling and monitoring*
CLR-4 :	*Analyse the project performance based on S-Curve and Earned Value*
CLR-5 :	*Analyze the basic concepts of various resources and its importance*
CLR-6 :	*Analyse the project performance based on Quality and Safety*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Accrue the knowledge the characteristics of project and planning aspects*	*2*	*85*	*75*	*H*	*L*	*M*	-	*L*	-	-	-	*H*	*H*	*H*	*M*	*H*	-	-
CLO-2 :	*Analyze the CPM and PERT problems and apply the concept of project planning*	*3*	*85*	*75*	*H*	*H*	*M*	*M*	-	-	-	-	*H*	-	*H*	*M*	*H*	-	-
CLO-3 :	*Accrue the knowledge project controlling and monitoring*	*2*	*85*	*75*	*L*	*H*	*M*	*H*	*M*	-	-	-	*M*	-	*H*	*M*	*H*	-	-
CLO-4 :	*Apply the mathematical techniques of S-Curve and Earned Value*	*3*	*85*	*75*	*H*	*H*	*M*	*H*	-	-	-	-	*L*	*M*	*H*	*M*	*H*	-	-
CLO-5 :	*Accrue the knowledge about Types of resourcesand its importance*	*2*	*85*	*75*	*H*	*L*	*L*	*L*	-	*M*	*H*	*L*	-	-	*H*	*M*	*H*	-	-
CLO-6 :	*Accrue comprehensive knowledge in Quality and safety*	*2*	*85*	*75*	*H*	*H*	*L*	*L*	-	*H*	-	*H*	*L*	-	*H*	*M*	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Basics of Construction- Unique features of construction*	*Work break-down structure*	*Planning and organizing construction site and resources*	*Resource Planning- Procurement, Identification*	*Quality control: concept of quality, quality assurance*
	SLO-2	*Construction projects types and features, Phases of a project*	*Activity lists*	*Site layout including enabling structures,*	*Types of resources, manpower, Equipment Material, Money, Time*	*Quality gurus*
S-2	SLO-1	*Project Life cycle*	*Estimating durations*	*developing site organization, Documentation at site*	*Systems approach In resource management, Characteristics of resources*	*TQM*
	SLO-2	*Construction project planning and competency skills*	*Sequence of activities, Activity utility data*	*Manpower: planning,*	*Resources Utilization, measurement of actual resources required-Tools for measurement of resources*	*use of manuals and checklists for quality control, role of inspection*
S-3	SLO-1	*Stages of project planning: pre-tender planning*	*Techniques of planning- Bar charts, Gantt Charts.*	*organizing, staffing, motivation*	*Material: Functions of Material Management*	*Basics of statistical quality control*
	SLO-2	*Pre-construction planning,*	*Networks: Basic terminology,*	*Histograms and S-Curves*	*Inventory cost, ABC analysis*	*Cost Of Quality(COQ) y, Quality audits*
S 4-5	SLO-1	*Detailed construction planning*	*AOA, AON*	*Earned Value*	*EOQ Model*	*Failure Mode & Effects Analysis (FMEA)*
	SLO-2	*Agencies involved and their methods of execution*	*Types of precedence relationships, Preparation of CPM networks*	*Supervision, Record keeping,*	*Equipment: Classification of Construction Equipment*	*Risk, Risk Management process*
S-6	SLO-1	*Process of development of plans and schedules*	*Activity on link and activity on node representation,*	*Periodic progress reports, periodical progress meetings*	*Factors Behind the selection of Construction of equipment*	*Risk Identification Process*
	SLO-2	*Role of client and contractor*	*critical and semi Critical paths*	*Updating of plans: purpose*	*Depreciation, Methods of Calculating Depreciation*	*Safety, Health and Environment on project sites*

Duration (hour)		9	9	9	9	9
S-7	SLO-1	*Feasibility study - preliminary analysis - market, technical, financial,*	*Computation of float values*	*Frequency and methods of updating*	*Classes of Labor, Labor Productivity*	*accident Causation Theories*
	SLO-2	*economic and ecological - detailed market and demand analysis- detailed technical analysis*	*Crashing Technique*	*Classification of costs, timecost trade-off in construction projects*	*Cost of Labour, Labour schedule, optimum use Labour*	*accidents; their cause Effects and preventive measures*
S-8	SLO-1	*Time value of money, NPV*	*PERT- Assumptions underlying PERT analysis,*	*Common causes of time and cost overruns*	*Resource Scheduling- Bar chart, line of balance technique*	*Cost of Accidents*
	SLO-2	*Contracts and Types*	*determining three time estimates, analysis,*	*Corrective measures*	*Resource constraints and conflicts*	*Occupational health problems in construction*
S-9	SLO-1	*Important Terminologies: Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination*	*Slack computations*	*Common Good Practices in Construction*	*Resource aggregation, allocation, smoothening and leveling*	*Organizing for safety and health.*
	SLO-2	*Bidding Process*	*Calculation of probability of completion.*	*Basics of Modern Project management systems*	*Resource smoothening problems*	*Safety inspection, Safety Audit*

Learning Resources	
1. *Kumar Neeraj Jha, "Construction project management", Dorling Kindersley, New Delhi.2013* 2. *Sengupta .B, Guha .H, "Construction management and planning", Tata Mcgraw Hill, New Delhi,2001* 3. *Sharma .S.C, "Construction engineering and management",KhannaPublishers,Delhi,2008*	4. *Prasanna Chandra, "Planning, Analysis, Selection, Financing, Implementation, and Review", 7 th Edition, Tata Mcgraw Hill, New Delhi, 2001.* 5. *Principles of Construction Management https://nptel.ac.in/courses/105104161/* 6. *Project Planning & Control https://nptel.ac.in/courses/105106149/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*		*40%*		*40%*		*40%*		*40%*	
	Understand										
Level 2	Apply	*40%*		*40%*		*40%*		*40%*		*40%*	
	Analyze										
Level 3	Evaluate	*20%*		*20%*		*20%*		*20%*		*20%*	
	Create										
	Total	100 %		100 %		100 %		100 %		100 %-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *Mr.Jayasankar k, Zonal Head (Technical Services) at UltraTech Cement Limited, jayasankar2411@gmail.com*	1. *Dr. Radhakrishna, R.V. College of Engineering (RVCE), radhakrishna@rvce.edu.in*	1. *Dr. L. Krishnaraj, SRM IST*
2. *Mr. V. Krishnaraju, Modec Offshore Production Systems Pvt. Ltd, krishnaraju.vaithiyanathan@modec.com*	2. *Dr. K.Yogeswari,, B.S. Abdur Rahman Crescent Institute of Science and technology, yogeswari@crescent.education*	2. *Mr. N. Ganapathy Ramasamy, SRM IST*

Course Code	18CEC304L	Course Name	CONSTRUCTION ENGINEERING & MANAGEMENT LABORATORY	Course Category	C	Professional Core	L	T	P	C
							0	0	2	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Understand the basic skills in network framing*			
CLR-2 :	*Identifying the Activity involved in construction projects*			
CLR-3 :	*Understand the concept of Scheduling*			
CLR-4 :	*Apply the concept of Planning and scheduling*			
CLR-5 :	*Identify the resource requirement*			
CLR-6 :	Identify resource allocation			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Accrue the knowledge in Project network diagrams*	*3*	*85*	*75*	*H*	*H*	-	-	-	*H*	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Analyze the construction activities and activity sequence*	*2*	*85*	*75*	*H*	*H*	-	-	-	*H*	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Accrue the knowledge in different scheduling charts*	*2*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	*H*	-	*H*	-	-
CLO-4 :	*Accrue the knowledge in planning of activities in order*	*2*	*85*	*75*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-5 :	*Develop the schedule with resources*	*3*	*85*	*75*	*H*	*H*	-	*M*	-	-	-	-	*H*	-	-	-	*H*	-	-
CLO-6 :	*Analyze over allocation and under allocation of resources*	*3*	*85*	*75*	*H*	*H*	-	*M*	-	-	-	-	*H*	-	-	-	*H*	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*MSP- Basic Network diagrammes*	*Resource list*	*Complete schedule for Institutional projects*	*Activity Entry*	*Complete schedule for Residential projects*
	SLO-2	*Terms involved*	*Resource assigning*		*Activity Entry*	
S-2	SLO-1	*Activity in projects*	*Resource analysis*	*Complete schedule for Infra structure projects*	*Activity Entry*	*Complete schedule for Residential projects*
	SLO-2	*Activity sequence*	*Resource usage*		*Activity Entry*	
S-3	SLO-1	*Main activities and Sub activities*	*Cost analysis*	*Complete schedule for Infra structure projects*	*Resource list*	*Complete schedule for Institutional projects*
	SLO-2	*Relationship line and precedence relationship*	*Tracking*		*Resource assigning*	
S-4	SLO-1	*Calendar design and assign*	*Complete schedule for Residential projects*	*Primavera Basics*	*Resource analysis*	*Complete schedule for Institutional projects*
	SLO-2	*Gantt chart and PERT diagram*		*EPS*	*Resource usage*	
S-5	SLO-1	*Activity resource estimation*	*Complete schedule for Residential projects*	*OBS and WBS*	*Cost analysis*	*Complete schedule for Infra structure projects*
	SLO-2	*Activity duration estimation*		*Types of calendar*	*Tracking*	
S-6	SLO-1	*Activity entry*	*Complete schedule for Institutional projects*	*Relationship lines and Constraints*	*Linking WBS, OBS and EPS*	*Complete schedule for Infra structure projects*
	SLO-2	Activity entry		New project Creation	Multiple project entry	

Learning Resources	
	1. *Laboratory Manual*
	2. *Feigenbaum.L, "Construction Scheduling with Primavera Project Planner", Prentice Hall Inc., 1999.*
	3. *"Project planning and management: Primavera Reference guide", CADD Centre training services*
	3. *4. Paul F. Aubin, "Mastering Autodesk Revit Building", Cengage Learning, March 2006.*
	4. *Robert M. Thomas, "Advanced AutoCAD Release" 12, ED 3, Wiley, John & Sons, Incorporated, 1993.*
	5. *"Project planning and management: MS Project specially for Civil professional", CADD Centre training services*
	6. *7. Geprge Omura," Introducing AutoCAD 2010 and AutoCAD LT 2010", Willey India Pvt. Ltd., 2010.*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Understand										
Level 2	Apply	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from Record and Model Examination.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *Mr. Jayasankar K, Zonal Head (Technical Services) at ultraTech cement Limited, jayasankar2411@gmail.com*	1. *Dr. Radhakrishna, R.V. College of Engineering (RVCE), radhakrishna@rvce.edu.in*	1. *Dr. L. Krishnaraj, SRMIST*
2. *Mr. V. Krishnaraju,, Modec Offshore Production Systems, pvt,ltd, krishnaraju.vaithiyanathan@modec.com*	2. *Dr. K.Yogeswari, B.S. Abdur Rahman Crescent Institute of Science and technology, yogeswari@crescent.education*	2. *Dr. M. Balasubramanian, SRMIST*

Course Code	18CEC350T	Course Name	COMPREHENSION	Course Category	C	Professional Core	L	T	P	C
							0	1	0	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*As Applicable*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Acquire skills to solve real world problems in Engineering Geology and Engineering Surveying*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	*Acquire skills to solve real world problems in Mechanics of Structures, Design of RCC & Steel and Structural Analysis*			
CLR-3 :	*Acquire skills to solve real world problems in Fluid Mechanics, Hydraulic Engineering Design and Hydrology*			
CLR-4 :	*Acquire skills to solve real world problems in Geotechnical Engineering*			
CLR-5 :	*Acquire skills to solve real world problems in Environmental Engineering*			
CLR-6 :	*Acquire skills to solve real world problems in Transportation Engineering*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*				Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*Practice and gain confidence to solve problems in Engineering Geology and Engineering Surveying*	*3*	*85*	*80*	*H*	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*M*	*H*
CLO-2 :	*Practice and gain confidence to solve problems in Mechanics of Structures, Design of RCC & Steel and Structural Analysis*	*3*	*85*	*80*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*M*	*H*
CLO-3 :	*Practice and gain confidence to solve problems in Fluid Mechanics, Hydraulic Engineering Design and Hydrology*	*3*	*85*	*80*	*H*	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*L*	*H*
CLO-4 :	*Practice and gain confidence to solve problems in Geotechnical Engineering*	*3*	*85*	*80*	*H*	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*L*	*H*
CLO-5 :	*Practice and gain confidence to solve problems in Environmental Engineering*	*3*	*85*	*80*	*H*	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*L*	*H*
CLO-6 :	*Practice and gain confidence to solve problems in Transportation Engineering*	*3*	*85*	*80*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*L*	*H*

Duration (hour)		3	3	3	3	3
S-1	SLO-1	*Tutorial on Engineering Geology and Engineering Surveying*	*Tutorial on Mechanics of Structures*	*Tutorial on Structural Analysis*	*Tutorial on Geotechnical Engineering*	*Tutorial on Environmental Engineering*
	SLO-2					
S-2	SLO-1	*Tutorial on Engineering Geology and Engineering Surveying*	*Tutorial on Design of RCC and Steel Structures*	*Tutorial on Fluid Mechanics and Hydraulic Engineering Design and Hydrology*	*Tutorial on Geotechnical Engineering*	*Tutorial on Transportation Engineering*
	SLO-2					
S-3	SLO-1	*Tutorial on Mechanics of Structures*	*Tutorial on Design of RCC and Steel Structures*	*Tutorial on Fluid Mechanics and Hydraulic Engineering Design and Hydrology*	*Tutorial on Environmental Engineering*	*Tutorial on Transportation Engineering*
	SLO-2					

Learning Resources	1. *Handa, S., and Rangaswamy, Civil Engineering Objective Type, Satya Prakashan, 2017* 2. *Agor, R., Objective Type and Conventional Questions and Answers on Civil Engineering for All Types of Examinations & Interviews, Khanna Publishers, 2019*	3. *Venkatramaiah, C., and Krishna Sharma, A., A Compendium of Objective Questions in Civil Engineering, Universities Press, 2014*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. G.Hariharanath, GA Consultants, Chennai, gac1996@hotmail.com	*1. Dr. G. Appa Rao, Professor, IIT Madras, garao@iitm.ac.in*	*1. Dr. K. S. Satyanarayanan, SRMIST*
2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. C. Uma Rani, Professor, Anna University, umarani@annauniv.edu*	*2. Prof. G. Augustine Maniraj Pandian, SRMIST*

ACADEMIC CURRICULA

Professional Elective Courses

CIVIL ENGINEERING

Regulations - 2018

Volume – 4 (5)

(Detailed Syllabus for Third & Fourth Year Courses)

SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Kancheepuram, Tamil Nadu, India

Course Code	18CEE301T	Course Name	FOUNDATION ENGINEERING AND DESIGN	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*CIVIL ENGINEERING*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understanding the essential steps involved in a Geotechnical Investigation*
CLR-2 :	*Analyze the principle types of foundation and the factors governing the choice of the most suitable type of foundation.*
CLR-3 :	*Get exposed to determination of bearing capacity of shallow foundation*
CLR-4 :	*Analyze the cause and remedial measures for settlement and slope failure*
CLR-5 :	*Get an insight into the load carrying capacity of pile foundation in the field condition*
CLR-6 :	*Understand and analyse the concept of earth pressure*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify the soil characteristics through geotechnical investigation*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Proper type of foundation is chosen depending upon the soil condition*	*2*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Compute g the bearing capacity of shallow foundation*	*2*	*80*	*75*	*H*	*H*	-	*H-*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-4 :	*Utilize the proper measures for reducing the settlement and slope failure*	*2*	*85*	*80*	*H*	*H*	-		-	-	-	-	-	-	-	-	*H*	-	-
CLO-5 :	*Utilize the proper type of pile in the field*	*2*	*85*	*75*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-6 :	*Estimate of earth pressure for different soil condition*	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Site investigation, soil Exploration*	*Definition: Foundation, purpose of foundation.*	*Combined footing - types*	*Deep foundation – Necessity. Pile Foundations classification*	*Lateral Earth Pressures Theories-Introduction:*
	SLO-2	*Planning and stages in site investigation*	*Definition: Shallow Foundation – classification. Ultimate, gross, net, safe bearing capacity. safe and allowable bearing pressure*	*Combined footing - types*	*Pile Foundations – classification*	*applications of earth pressure theories*
S-2	SLO-1	*Soil exploration – Methods – direct, semi-direct and indirect method*	*Bearing capacity failure - modes of shear failures – general, local and punching shear failure*	*Method of proportioning – Rectangular footing*	*Load carrying capacity of pile – Methods*	*Different types of earth pressure at rest, active and passive pressure*
	SLO-2	*Direct method – test pit, trenches*	*Factors affecting bearing capacity*	*Method of proportioning – Rectangular footing*	*Dynamic method – ENR, and Hiley's - Problems*	*Different types of earth pressure at rest, active and passive pressure*
S-3	SLO-1	*Indirect methods. Geophysical methods- Seismic Refraction Method*	*Bearing capacity determinations – Methods.*	*Method of proportioning – Trapezoidal footing*	*Static method – all type of soils - problems*	*Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal backfill for cohesion-less soil*
	SLO-2	*Geophysical methods- Electrical Resistivity Method*	*Terzaghi theory – Assumption.*	*Method of proportioning – Trapezoidal footing*	*Static method – all type of soils - problems*	*Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal backfill for cohesion-less soil*
S-4	SLO-1	*Indirect method – SPT*	*Bearing capacity – Strip and Square foundation*	*Combined footing - problems*	*Static method – all type of soils - problems*	*Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal backfill for cohesion-less soil-Problems*

	SLO-2	*Indirect method – SPT*	*Bearing capacity – Circular and Rectangular foundation*	*Combined footing - problems*	*Static method – all type of soils - problems*	*Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal backfill for cohesion-less soil-Problems*
S-5	SLO-1	*Indirect method – DCPT*	*Bearing capacity – effect of water table*	*Settlement – total and differential settlement.*	*Pile load capacity – penetration test results*	*Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal backfill for cohesive soils.*
	SLO-2	*Indirect method –SCPT*	*Bearing capacity – effect of water table*	*Settlement – total and differential settlement.*	*Pile load capacity – penetration test results*	*Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal backfill for cohesive soils*
S6	SLO-1	*Semi direct method Borings – auger*	*Bearing capacity - problems*	*Causes and methods to minimize the total settlement*	*Pile group – efficiency - problems*	*Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal backfill for cohesive soils-Problems*
	SLO-2	*Semi direct method Borings –shell and auger*	*Bearing capacity - problems*	*Causes and methods to minimize the total settlement*	*Pile group – efficiency - problems*	*Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal backfill for cohesive soils-Problems*
S-7	SLO-1	*Semi direct method Borings – wash boring and rotary drilling*	*Bearing capacity - problems*	*Causes and methods to minimize the differential settlement*	*Pile group – efficiency - problems*	*Earth pressure theories – Graphical method*
	SLO-2	*Semi direct method Borings – percussion method*	*Bearing capacity - problems*	*Causes and methods to minimize the differential settlement*	*Pile group – efficiency - problems*	*Earth pressure theories – Graphical method*
S-8	SLO-1	*Number and deposition of trail pits and borings*	*Hansen and IS code method*	*Slopes – types – Causes of slope failure*	*Pile load test : Types - Load carrying capacity of pile, under-reamed pile and pile group*	*Rebhann's Construction for Active Pressure*
	SLO-2	*Bore log details*	*Bearing capacity from Penetration test results*	*Methods to minimize the slope failure*	*load test as per BIS – estimation of load carrying capacity*	*Rebhann's Construction for Active Pressure*
S-9	SLO-1	*Soil Sample ; UDS*	*Bearing capacity : Plate load test as per BIS ,*	*Slope stability – methods - Swedish Method of Slice for a Cohesive-frictional Soil*	*Problems in pile load test.*	*Culmann'sgraphical solutions for active and passive case*
	SLO-2	*Soil Sample ; DS*	*limitations and estimation of settlements - Performance of foundation*	*Slope stability – methods - Swedish Method of Slice for a Cohesive-frictional Soil*	*Negative skin friction*	*Culmann'sgraphical solutions for active and passive case*

Learning Resources	1. *Joseph.E Bowles, "Foundation Analysis and Design", Mc Graw Hill Publishing co., 2001.* 2. *Murthy .V.N.S, "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishersand Distributors, New Delhi, 2009.* 3. *Arora .K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2011.* 4. *Varghese, P.C., "Foundation Engineering", PHI Learning New Delhi. 2011*	5. *Punmia.B.C., "Soil Mechanics and Foundations", Laxmi publications Pvt Ltd., 2000.* 6. *Das .B.M, "Principles of Foundation Engineering", (Fifth Edition), Thomson Books, 2010.* 7. *NPTEL Course – Advanced Foundation Engineering : https://nptel.ac.in/courses/105105039/* 8. *NPTEL Course – Foundation Engineering : https://nptel.ac.in/courses/105101083/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*50%*	-	*40%*	-	*40%*	-	*45%*	-	*70%*	-
	Understand										
Level 2	Apply	*50%*	-	*60%*	-	*60%*	-	*55%*	-	*30%*	-
	Analyze										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4: Assignments and / or Field visits

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. P.Selvanambi, Divisional Engineer (Highways), sundariselvam@yahoo.com	*Dr.M.Muttharam, Anna University, muttharam@annauniv.edu*	*Dr. P.T. Ravichandran, SRMIST*
Mr.Lenin K.R., Head –GEOTECH, SECON Private Limited, Bangalore, lenin.kr@secon.in	*Dr.V.Murugaiyan, Pondichery Engineering College, vmurugaiyan@pec.edu*	*Ms. S. Mary Rebekah Sharmila, SRMIST.*

Course Code	18CEE302T	Course Name	GEOTECHNICAL DESIGN	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	Nil	Progressive Courses	*Nil*
Course Offering Department	*CIVIL ENGINEERING*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand the essential steps involved in a Geotechnical Investigation*
CLR-2 :	*Understand the concept of consolidation and the estimation of preconsolidation pressure*
CLR-3 :	*Analyze the stress strain behavior of different types of soil*
CLR-4 :	*Compute of the ultimate load carrying capacity of shallow foundation under different field condition*
CLR-5 :	*Estimate of pile load capacity and settlement of single and group of piles*
CLR-6 :	*Utilize the ultimate loads of shallow and pile foundation in the civil engineering field*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Analyze the soil properties based on geotechnical investigation*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Utilize the preconsolidation pressure for determining the rate of consolidation*	*2*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Utilize the stress strain behavior of soil in the field*	*2*	*80*	*75*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-4 :	*Identify the application of ultimate loads of shallow foundation in the field*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-5 :	*Identify the application of ultimate loads of pile foundation in the field*	*2*	*85*	*75*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-6 :	*Apply of shallow and deep foundation in the field*	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Planning of subsurface investigation*	*Terzaghi's theory of one dimensional consolidation*	*Stress and strain behavior of soil*	*Bearing capacity and settlement analysis of shallow foundations: Modes of failure*	*Pile foundation: Functions*
	SLO-2	*Purpose and scope*	*Terzaghi's theory of one dimensional consolidation*	*Stress and strain behavior of soil*	*Bearing capacity and settlement analysis of shallow foundations: Modes of failure*	*Pile foundation: Functions*
S-2	SLO-1	*Influence of soil conditions on exploratory program*	*Derivation of Terzaghi's equation (solution in detail need not be covered)*	*Triaxial test -drained and un-drained behavior of sand*	*Failure criteria, Prandtl Reissner Method, Assumptions - Estimation of ultimate loads,*	*Types of pile foundations*
	SLO-2	*Type of foundation on exploratory program*	*Derivation of Terzaghi's equation (solution in detail need not be covered)*	*Triaxial test -drained and un-drained behavior of sand*	*Failure criteria, Prandtl Reissner Method, Assumptions - Estimation of ultimate loads,*	*Types of pile foundations*
S-3	SLO-1	*Subsurface soundings –Static methods*	*Estimation of Cc and Cv from laboratory tests*	*Triaxial test -drained and un-drained behavior of clays*	*Terzaghi solution, Assumptions - Estimation of ultimate loads*	*Pile load tests, Use of load tests*
	SLO-2	*Subsurface soundings –Static methods*	*Estimation of Cc and Cv from laboratory tests*	*Triaxial test -drained and un-drained behavior of clays*	*Terzaghi solution, Assumptions - Estimation of ultimate loads*	*Pile load tests, Use of load tests*
S-4	SLO-1	*Subsurface soundings – Dynamic methods*	*Estimation of Cc and Cv from laboratory tests*	*Failure criteria in soils –only Mohr – Coulomb's criteria*	*Estimation of ultimate loads- Effect of shape,*	*Methods of estimation of pile load capacity- Static and dynamic*
	SLO-2	*Subsurface soundings – Dynamic methods*	*Estimation of Cc and Cv from laboratory tests*	*Failure criteria in soils –only Mohr – Coulomb's criteria*	*Estimation of ultimate loads- Effect of shape,*	*Methods of estimation of pile load capacity- Static and dynamic*
S-5	SLO-1	*Planning of subsurface investigations*	*Estimation of Pc by various methods*	*Ideal, plastic and real soil behavior*	*Estimation of ultimate loads- embedment of footing*	*Estimation of single pile capacity by static*
	SLO-2	*Planning of subsurface investigations*	*Estimation of Pc by various methods*	*Ideal, plastic and real soil behavior*	*Estimation of ultimate loads- embedment of footing*	*Estimation of single pile capacity by static*
S6	SLO-1	*Planning of subsurface investigations*	*Field consolidation curves*	*Shear strength of sand and clays*	*Estimation of ultimate loads- eccentricity in loading*	*Estimation of single pile by dynamic methods*

	SLO-2	*Planning of subsurface investigations*	*Field consolidation curves*	*Shear strength of sand and clays*	*Estimation of ultimate loads- eccentricity in loading*	*Estimation of single pile by dynamic methods*
S-7	SLO-1	*Type and sequence of operations*	*Quasi pre-consolidation*	*Estimation of stresses: Boussinesq's theory*	*Compressibility (including critical rigidity index), Choice of factor of safety, Settlement of foundations on sand –Schmertmann method*	*Group capacity of piles*
	SLO-2	*Type and sequence of operations*	*Quasi pre-consolidation*	*Estimation of stresses: Boussinesq's theory*	*Compressibility (including critical rigidity index), Choice of factor of safety, Settlement of foundations on sand –Schmertmann method*	*Group capacity of piles*
S-8	SLO-1	*Lateral extent and depth of exploration*	*Quasi Secondary consolidation*	*Estimation of stresses: Westergard's theory*	*Foundations on collapsing and swelling soils, non-uniform soils, compressible soils and on rock*	*Separation of skin friction and end bearing capacity*
	SLO-2	*Lateral extent and depth of exploration*	*Quasi Secondary consolidation*	*Estimation of stresses: Westergard's theory*	*Foundations on collapsing and swelling soils, non-uniform soils, compressible soils and on rock*	*Separation of skin friction and end bearing capacity*
S-9	SLO-1	*Interpretation of field and laboratory data*	*Practical applications*	*Estimation of stresses: Newmark's charts*	*Design of isolated and combined footings*	*Settlement of single and group of piles.*
	SLO-2	*Interpretation of field and laboratory data*	*Practical applications*	*Estimation of stresses: Newmark's charts*	*Design of isolated and combined footings*	*Settlement of single and group of piles.*

Learning Resources	1. *Joseph.E Bowles, "Foundation Analysis and Design", Mc Graw Hill Publishing co., 2001.* 2. *Murthy .V.N.S, "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishersand Distributors, New Delhi, 2009.* 3. *Arora .K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2011.*	4. *Varghese, P.C., "Foundation Engineering", PHI Learning New Delhi. 2011* 5. *Punmia.B.C., "Soil Mechanics and Foundations", Laxmi publications Pvt Ltd., 2000.* 6. *Das .B.M, "Principles of Foundation Engineering", (Fifth Edition), Thomson Books, 2010.* 7. *NPTEL Course – Foundation Design : https://nptel.ac.in/courses/105104162/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*50%*	-	*40%*	-	*40%*	-	*45%*	-	*70%*	-
	Understand										
Level 2	Apply	*50%*	-	*60%*	-	*60%*	-	*55%*	-	*30%*	-
	Analyze										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 : Assignments and / or Field visits

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. P.Selvanambi, Divisional Engineer (Highways), sundariselvam@yahoo.com	*Dr.M.Muttharam, Anna University, muttharam@annauniv.edu*	*Dr. P.T. Ravichandran, SRMIST*
Mr.Lenin K.R., Head –GEOTECH, SECON Private Limited, Bangalore, lenin.kr@secon.in	*Dr.V.Murugaiyan, Pondichery Engineering College, vmurugaiyan@pec.edu*	*Ms.S. Mary Rebekah Sharmila, SRMIST.*

Course Code	18CEE303T	Course Name	GROUND IMPROVEMENT TECHNIQUES	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*CIVIL ENGINEERING*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand the need for ground improvement*
CLR-2 :	*Understand the techniques adopted for ground improvement with respect to hydraulic modification*
CLR-3 :	*Identify conceptual and practical understanding of in-situ soil densification techniques*
CLR-4 :	*Familiarize with soil chemical modification techniques and acquaintance with emerging technologies*
CLR-5 :	*Understand the mechanism and concept related to soil modification by reinforcements*
CLR-6 :	*Recommend and design cost effective ground improvement techniques for difficult practical soil conditions*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Gain a thorough knowledge on the role of ground improvement techniques in the infrastructure development*	*2*	*85*	*80*	*H*	*L*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Recommend hydraulic modification techniques for related problems*	*2*	*85*	*75*	*H*	*M*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Apply densification techniques for loose sand deposits and alternative techniques for soft clay deposits*	*2*	*80*	*75*	*H*	*M*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-4 :	*Recommend additives and frame soil chemical modification schemes for stabilizing problematic soil*	*2*	*85*	*80*	*H*	*M*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-5 :	*Design geotechnical structures using reinforcements like reinforced earth retaining walls, slopes, foundations etc.,.*	*3*	*85*	*75*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-6 :	*Recommend design efficient and economic alternatives using ground improvement techniques for problematic and difficult sites*	*3*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction-Ground improvement techniques*	*Hydraulic modification-concept and principle*	*In-situ densification of cohesionless soil*	*Grouting -introduction*	*Soil reinforcement concepts*
	SLO-2	*Role of ground improvement techniques in foundation engineering*	*Dewatering -objectives -types*	*Various Methods and mechanism involved*	*Necessity types of grout-suspension-solution grouts*	*Principle and mechanism*
S-2	SLO-1	*Objectives and scope of ground improvement techniques*	*Dewatering Techniques -well points system*	*Consolidation of cohesive soil-types*	*Functions of grouting-permeation*	*Reinforced earth retaining structures-various applicability in geotechnical engineering*
	SLO-2	*Classification of techniques adopted*	*Installation -mechanism and suitability of soil*	*Properties and behaviour*	*Functions-Compaction-hydro fracture*	*Embankments -slopes etc..*
S-3	SLO-1	*Hydraulic-Mechanical-Chemical-Reinforcement*	*Dewatering methods-Ditches*	*Vibrofloatation techniques*	*Grouting equipment and methods*	*Types of reinforcing materials*
	SLO-2	*Choice of method of ground improvement techniques*	*Dewatering methods-Sumps*	*Dry feed method-wet feed method*	*Grouting with soil, bentonite*	*Natural and manmade materials*
S-4	SLO-1	*Geotechnical problems in Lateritic soil*	*Dewatering methods -Vacuum method.*	*Sand compaction piles*	*Grouting with cement mixes*	*Geosynthetics-types*
	SLO-2	*Properties and behavior and techniques adopted*	*Dewatering methods-Electroosmotic method*	*Installation techniques*	*Mechanism and concept*	*Geotextile-geogrids-geonets*

S-5	SLO-1	*Geotechnical problems in Alluvial soil*	*Seepage analysis of 2-dimensional flow-concepts*	*Deep compaction -dynamic compaction - blasting technique*	*Grout injection methods*	*Functions of geosynthetics*
	SLO-2	*Properties and behavior and techniques adopted*	*Theory and problems*	*Concepts and factors influencing*	*grout monitoring schemes*	*Filtration, drainage*
S6	SLO-1	*Geotechnical problems in Black Cotton soil*	*Seepage analysis-fully penetrated slot*	*Stone columns -installation*	*Civil engineering application of grouting techniques*	*Geosynthetics-Reinforcement*
	SLO-2	*Properties and behavior and techniques adopted*	*Theory and problems*	*Mechanism*	*Some of the field studies*	*Separation function -Geotechnical field application*
S-7	SLO-1	Selection of suitable ground improvement techniques based on soil condition	Preloading-concept	Design criteria	Stabilization -concept	Geomembranes-containments
	SLO-2	Some field conditions for practical applicability	Field applicability	Stone column- soil criteria-field application	Stabilization of expansive soil	Barriers- field application
S-8	SLO-1	Use of Piezometers	Vertical drains-sand drains	Lime columns-applicability	Lime stabilization-concept-suitability criteria	Current practices-geosynthetics
	SLO-2	Field applications	Installation and mechanism	Soil criteria-mechanism involved	Mechanism involved	Field application reinforcement
S-9	SLO-1	Use of inclinometers	Prefabricated vertical drains	Field application	Cement stabilization -concept-suitability criteria	Geosynthetics in field applications
	SLO-2	Field applications	Installation and mechanism	Installation -mechanism	Mechanism involved	Introduction of ground anchors

Learning Resources	1. *Purushothama Raj. P, "Ground Improvement Techniques", Lakshmi Publications, 2ndEdition, 2016.* 2. *Manfired R. Hausmann, Engineering Principles of Ground Modification, McGraw-Hill Pub, Co., 1990.* 3. *Koerner, R.M. "Construction and Geotechnical Methods in Foundation Engineering", McGraw Hill, 1994.*	4. *Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas Publishing House, FirstEdition, 2012.* 5. *Mittal.S, "An Introduction to Ground Improvement Engineering", Medtech Publisher, First Edition, 2013.* 6. *NPTEL Course - Advanced Techniques in Geotechnical and Foundation Engineering : https://nptel.ac.in/courses/105106144/* 7. *NPTEL Course - Ground Improvement Techniques : https://nptel.ac.in/courses/105108075/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. P.Selvanambi, Divisional Engineer (Highways), sundariselvam@yahoo.com	*Dr.M. Muttharam, Anna University, muttharam@annauniv.edu*	*Dr. P.T. Ravichandran, SRMIST*
Mr. K.R. Lenin Head –GEOTECH, SECON Private Limited, Bangalore, lenin.kr@secon.in	*Dr.V. Murugaiyan, Pondichery Engineering College, vmurugaiyan@pec.edu*	*Dr. S. Bhuvaneshwari, SRMIST*

Course Code	18CEE304T	Course Name	FOUNDATION ON EXPANSIVE SOIL	Course Category	E	*Professional Elective Course*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*CIVIL ENGINEERING*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Understand the occurrence and distribution of expansive soils
CLR-2 :	Deals the properties of expansive soils
CLR-3 :	Identify the various methods of prediction of heave
CLR-4 :	Analyse the design procedure for foundation on expansive soils
CLR-5 :	Identify the various methods of stabilization used in expansive soils
CLR-6 :	Create overall knowledge on properties and performance of expansive soil and design of foundation on expansive soil

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	*2*	*3*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Gaining the knowledge of the occurrence and distribution of expansive soils	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	Identify the properties of expansive soils	*2*	*85*	*75*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	Identify the knowledge on various methods of prediction of heave	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-4 :	Apply the design procedure for foundation on expansive soils	*3*	*85*	*80*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-5 :	Analyse the various methods of stabilization used in expansive soils	*2*	*85*	*80*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-6 :	Acquire knowledge on design of suitable foundations on expansive soil	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-

Duration (hour)		09	09	09	09	09
S-1	SLO-1	*Introduction- Expansive soils an overview*	*Soil structure – coarse grained soil*	*Clay mineralogy - Types of Clay minerals*	*Design alternatives*	*Methods Controlling Swelling characteristics of expansive soil – Prewetting*
	SLO-2	*Occurrence of expansive soil*	*Soil structure – Fine grained soil*	*Basic structural unit*	*Structural Alternatives – Soil Alternatives*	*Surface and subsurface drainage*
S-2	SLO-1	*Distribution of expansive soil*	*Composite structure*	*Synthesisation of clay mineral*	*Isolation of structre from soil*	*Treatment of expansive soils -Surcharge loading,*
	SLO-2	*Nature of expansive soil with moisture content*	*Specific surface - adsorbed and absorbed water*	*Properties and characterisation of clay minerals*	*Recommendations for type of foundation in expansive soils*	*Concept Moisture barriers - Horizontal moisture barriers*
S-3	SLO-1	*Environmental interaction*	*Field exploration methods soils - Sounding test*	*Minerological methods - X – Ray diffraction*	*Design consideration - Individual*	*Moisture barriers - Vertical moisture barriers*
	SLO-2	*Physical properties of expansive soils*	*Identification of expansive – laboratory methods*	*Differential Thermal Analysis*	*Design consideration - Continuous footings*	*Soil replacement with compaction control*
S-4	SLO-1	*Effect of expansive soils on structures*	*Atterberg limit*	*Electron microscopy*	*Stiffened mats - Codal provisions.*	*Soil Stabilization-concept*
	SLO-2	*Problems and Remedies of expansive soils*	*CEC*	*Potential Volume Change*	*Under reamed piles - Design*	*Mechanical stabilization – Types and concept*
S-5	SLO-1	*Identification of expansive soils*	*Swelling characteristics – Laboratory tests*	*Expansion Index Test*	*Under reamed piles construction*	*Chemical stabilisation*
	SLO-2	*Assessment of Expansion Potential*	*Swell potential identification from Atterberg limit*	*Coefficient Of Linear Extensibility (Cole)*	*Advantages and disadvantages of Under reamed piles*	*Cement stabilization- Advantages and disadvantages*

S6	SLO-1	*Moisture equilibrium – concept*	*Casagrande's PI-LL Chart*	*Methods of prediction of heave - Empirical methods*	*Double under reamed pile*	*Lime stabilization – mechanism involved and its limitations*
	SLO-2	*Stable and unstable zone*	*Swell potential identification from Activity index and particle size*	*Soil suction – Osmotic and matric*	*Load test on Under reamed pile*	*Bituminous stabilization*
S-7	SLO-1	*Shrink – swell potential of expansive soil*	*Diffferential free swell – classification using engineering properties*	*Measurement of soil suction - methods*	*Estimation of load carrying capacity from under reamed pile*	*Thermal stabilization- Thermal Technique- concept*
	SLO-2	*Field conditions that favour swelling*	*Swell Pressure mesaruement*	*Tensio meter*	*Belled piers – Bearing capacity and skin friction*	*Thermal stabilization – Freezing Technique- concept*
S-8	SLO-1	*Consequences of swelling*	*Analysis on swell pressure*	*Axis translation*	*Advantages and disadvantages of belled piers*	*Industrial waste in soil stabilisation*
	SLO-2	*Distress symptoms*	*Isomporphous substitution*	*Psychrometers*	*Stiffened slab on grade*	*Use of fly ash in soil stabilsation*
S-9	SLO-1	*Damage on Foundations from Expansive Soils*	*Diffused double layer of water*	*Filter paper method*	*Drilled pier and beam*	*Types of fly ash - characteristics*
	SLO-2	*Factors influencing swelling and shrinkage of soils*	*Specific surface area*	*Thermal Matric Potential Sensors*	*Underpinning method*	*Sustainable materials in stabilisation*

Learning Resources	1. *John .D.N & Debora .J.M, "Expansive Soils Problems and Practice In Foundation & Pavement Engineering", 1992.* 2. *Chenn.F.R, "Foundation on Expansive Soils"- Elsevier, 1973.*	3. *Parcher.J.V & Means .R.E, "Soil Mechanics and Foundations", Columbus, 1968.* 4. *Boominathan. S,"Lecture Notes on Structures on Expansive Soil", College of Engineering,Guindy, Anna University, Chennai. 1990.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*30%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	30%	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 : Assignments and / or Multiple choice Quizzes

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. P.Selvanambi, Divisional Engineer (Highways) , sundariselvam@yahoo.com	*Dr.M.Muttharam, Anna University, muttharam@annauniv.edu*	*Dr. P.T. Ravichandran, SRMIST*
Mr. K.R. Lenin., Head –GEOTECH, SECON Private Limited, Bangalore, lenin.kr@secon.in	*Dr.V.Murugaiyan, Pondichery Engineering College, vmurugaiyan@pec.edu*	*Ms. Divya Krishnan K, SRMIST*

Course Code	18CEE305J	Course Name	CONCRETE TECHNOLOGY	Course Category	E	*Professional Elective*	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*IS 10262: 2019 and IS 456: 2000*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand and test the properties of materials constitutes concrete*
CLR-2 :	*Understand about chemical and mineral admixtures used in concrete. Also understand and test fresh concrete properties*
CLR-3 :	*Know and understand the properties of concrete in hardened state*
CLR-4 :	*Know and understand the durability properties of concrete and special concrete*
CLR-5 :	*Understand the importance of concrete mix design*
CLR-6 :	*Understand the process involved in manufacture of concrete*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*Test and study the properties of cement, aggregates and water*	*3*	*80*	*75*	*H*	*M*	-	-	-	-	-	-	-	-	-	-	*L*	*H*	*M*
CLO-2 :	*Know the effects of admixtures in concrete and test the fresh concrete properties*	*3*	*85*	*75*	*H*	*M*	-	-	-	-	-	-	-	-	-	-	*L*	*H*	*M*
CLO-3 :	*Test the hardened concrete properties*	*3*	*75*	*75*	*H*	*M*	-	-	-	-	-	-	-	-	-	-	*L*	*H*	*M*
CLO-4 :	*Understand the importance of durability of concrete and properties of special concrete*	*3*	*90*	*80*	*H*	*L*	-	-	-	-	-	-	-	-	-	-	*L*	*H*	*M*
CLO-5 :	*Design the concrete mix without and with admixtures*	*3*	*85*	*75*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	*M*	*H*	*M*
CLO-6 :	*Know the various stages of manufacture of concrete*	*3*	*80*	*75*	*H*	*L*	-	-	-	-	-	-	-	-	-	-	*L*	*H*	*M*

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*CONCRETE CONSTITUENTS MATERIALS* *Overview. Cement, brought up, invention, chemical composition, oxide composition, limits and role.*	*ADMIXTURES* *Overview –Chemical and mineral admixtures – additive – plasticizers – definition – situation need high workability – effects of plasticizer in concrete.*	*HARDENED CONCRETE* *Test – purpose – density - compressive strength test.*	*DURABILITY OF CONCRETE* *Definition - significance – permeability – reasons for permeability in actual structures.*	*CONCRETE MIX DESIGN* *Definition – Principle of mix design – Factors choice of mix proportion – Properties of concrete related to mix design.*
	SLO-2	*Hydration - Bogue's compound – types of cement.*	*Super plasticizers – effects in – fresh and hardened concrete.*	*Factors affects strength of concrete. Failure of compression specimen.*	*Joints in concrete – classifications.*	*Physical properties of materials required for mix design.*
S-2	SLO-1	*Properties of cement - Tests on cement – field.*	*Accelerators – accelerating plasticizer.*	*Flexural strength – central point load.*	*Concrete subjected to high temperature.*	*Nominal and design mix – variables in mix design.*
	SLO-2	*Laboratory tests – fineness – specific gravity – procedures.*	*Retarders – use – materials. Water proofers.*	*Flexural strength –third point load.*	*Freezing and thawing.*	*Objective of mix design – List of methods of mix design. Basic steps –– Information required for mix design.*
S-3	SLO-1	*Determination of fineness of cement and normal consistency of cement practically in lab.*	*Determination of soundness of cement (Demo only) practically in lab.*	*Determination of crushing strength of coarse aggregate practically in lab.*	*Determination of flakiness and elongation index of coarse aggregate practically in lab.*	*Determination of flexural strength of concrete practically in lab.*
	SLO-2					
S-4	SLO-1	*Consistency - setting time of cement – initial and final setting time.*	*Fly ash – characteristics – use – classification –effects in fresh and hardened concrete.*	*Indirect tension test.*	*Sulphate attack – methods to control.*	*Indian standard method of mix design - Step by step mix design procedure.*

	SLO-2	*Soundness and strength of cement.*	*Silica fume – characteristics – effects in fresh and hardened concrete.*	*Stress – strain curve.*	*Acid attack – concrete in sea water.*	*Mix design example : Without admixture*
S-5	SLO-1	*Aggregates – classification – source - size – shape – texture.*	*GGBS - effects in fresh and hardened concrete – uses.*	*Modulus of elasticity –determination.*	*Carbonation - factors.*	*Mix design examples: With chemical admixture and mineral admixture*
	SLO-2	*Properties of aggregates and tests: Crushing – 10% fines – impact.*	*Metakaolin – application – advantages – uses.*	*Different elastic moduli.*	*Chloride attack – limits of chloride.*	
S-6	SLO-1	*Determination of initial setting time of cement and final setting time (Demo only) - practically in lab.*	*Determination of fineness modulus of coarse aggregate practically in lab.*	*Determination of impact resistance of coarse aggregate practically in lab.*	*Compressive strength of bricks and concrete cubes practically in lab.*	*Determination of split tensile strength of concrete practically in lab.*
	SLO-2					
S-7	SLO-1	*Abrasion – bulk density – specific gravity Absorption and moisture content – bulking.*	*FRESH CONCRETE Workability –factors – tests.*	*Impact resistance test – Impact energy.*	*Effects of some materials on durability.*	*MANUFACUTRE OF CONCRETE Process – various stages of manufacture of concrete.*
	SLO-2	*Soundness – flakiness index – elongation index.*	*Slump and compaction factor tests.*	*Impact energy calculation*	*Surface treatments of concrete – materials used.*	*Batching – mixing*
S-8	SLO-1	*Grading – sieve analysis – fineness modulus.*	*Segregation – types – conditions – remedies.*	*Shrinkage – classifications – factors affect.*	*Concrete permeability test - Rapid chloride penetration test.*	*Transporting – Methods adopted for transportation of concrete.*
	SLO-2	*Water – quality – quantity.*	*Bleeding – effects – test.*	*Creep – definition – measurement of creep – factors affect.*	*Introduction to special concretes.*	*Placing – compacting - curing – finishing.*
S-9	SLO-1	*Determination of specific gravity of cement, fine and coarse aggregate practically in lab*	*Determination of bulking of sand practically in lab.*	*Determination of abrasion resistance of coarse aggregate practically in lab.*	*Workability of concrete – slump – compaction factor test practically in lab.*	*Determination of impact strength of concrete practically in lab.*
	SLO-2					

Learning Resources	1. *Neville, A.M. Properties of Concrete, Fifth Edition, Pearson, 2011.* 2. *Shetty, M.S. Concrete Technology, Theory and Practice, S. Chand & Company, New Delhi, 2013.* 3. *A.R. Santhakumar, Concrete Technology, 2009 Edition, Oxford University Press*	4. *Kumar Mehta Paulo,P and Monteiro, J.M. Concrete Microstructure, Properties and Materials, Fourth Edition, McGraw Hill Education, 2006, copy right ©2014.* 5. *NPTEL Course: Concrete Technology: https://nptel.ac.in/courses/105102012/* 6. *Laboratory Manual - SRMIST*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember / Understand	*20 %*	*20 %*	*15 %*	*15 %*	*15 %*	*15 %*	*15 %*	*15 %*	*15 %*	*15 %*
Level 2	Apply / Analyze	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*
Level 3	Evaluate / Create	*10 %*	*10 %*	*15 %*	*15 %*	*15 %*	*15 %*	*15 %*	*15 %*	*15 %*	*15 %*
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. G.Hariharanath, GA Consultants, Chennai, gac1996@hotmail.com	*1. Dr. R. Santhakumar, Professor, Centre for Rulal Department, NITTTR*	*1. Dr. K. Gunasekaran, SRMIST*
2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. P. Jayabalan, NIT, Trichy, pjeya@nitt.edu*	*2. Dr. P. R. KannanRajkumar, SRMIST*

Course Code	18CEE306T	Course Name	PRESTRESSED CONCRETE STRUCTURES	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	*Co-requisite Courses*	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*IS 1343: 2012*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Know and utilize the concepts of prestress concrete to analyseprestress concrete sections*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	*Know and understand the different losses of prestress and anchorage zone stress to design*			
CLR-3 :	*Understand flexural failure types and to analyze and also to design flexural and tension members*			
CLR-4 :	*Understand shear strength analyze and also to design for shear. Also to analyze due to torsion*			
CLR-5 :	*Know the design concept of prestressed concrete one way and two way slab*			
CLR-6 :	*Know the design concept of prestressed concrete flat slab*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO-1 :	*Analyze the prestress concrete sections using different concepts*	*3*	*80*	*75*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	*M*
CLO-2 :	*Analyze the different losses of prestress and anchorage zone stress to design*	*3*	*85*	*75*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	*M*
CLO-3 :	*Analyze and design of prestressed concrete flexural and tension members*	*3*	*75*	*75*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	*M*
CLO-4 :	*Analyze and design of prestressed concrete for shear and also analyze due to torsion*	*3*	*90*	*80*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	*M*
CLO-5 :	*Design the prestressed concrete one way and two way slab*	*3*	*85*	*75*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	*M*
CLO-6 :	*Design the prestressed concrete flat slab*	*3*	*80*	*75*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	*M*

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*PRESTRESSED CONCRETE Introduction - Basic concept – Principle of prestressing – Materials.*	*LOSSES OF PRESTRESS Nature of losses of prestress – types of losses of prestress in – pre and post tensioning.*	*FLEXURAL STRENGTH ANALYSIS Flexural failure - control parameters.*	*SHEAR STRENGTH ANALYSIS Shear and principal stresses – maximum and minimum principal stresses.*	*PRESTRESSED CONCRETE SLAB Slabs types –cross section of floor panels.*
	SLO-2	*Forms of steel – systems of prestressing*		*Types of flexural failure.*	*Eliminate diagonal tension cracks - improvement of shear resistance.*	
S-2	SLO-1	*Types of prestressing – uses of prestressed concrete.*	*Loss due to elastic deformation*	*Indian code provisions – moment of resistance – bonded tendons only.*	*Example without and with axial prestress*	*Design of one-way slab*
	SLO-2	*Materials – concrete strength limitation – requirements of steel for prestressed concrete.*	*Example*	*Rectangular section*		
S-3	SLO-1	*Analysis – basic assumptions.*	*Loss due to shrinkage and creep of concrete*	*Examples*	*Example with curved cable and vertical cable.*	*Example*
	SLO-2	*Concentric and eccentric tendons – resultant stresses – at transfer – at service. Concepts of prestressing – rectangle – symmetrical I-section only.*	*Example*			

S-4	SLO-1	*Stress concept*	*Loss due to relaxation of steel – friction – anchorage slip.*	*T – Sections. Neutral axis – within the flange – outside the flange.*	*DESIGN FOR SHEAR* *Types of shear cracks – sections uncracked in flexure – sections cracked in flexure.*	*Example*
	SLO-2		*Example*	*Examples*	*Design of shear reinforcement*	
S-5	SLO-1	*Stress concept – examples*	*ANCHORAGE ZONE STRESSES* *Anchorage zone – nature of stresses – objective.*	*DESIGN FOR FLEXURE* *Stress conditions - minimum section modulus – critical combinations – four fundamental conditions – at transfer – at service loads.*	*Examples*	*Design of two-way slab*
	SLO-2		*Stress distribution in end block – single and double anchor plates – ideal stress distribution.*	*Minimum prestressing force – maximum eccentricity.*		
S-6	SLO-1	*Stress concept - examples*	*Effect of transverse tensile stress*	*Examples*	*Examples*	*Example*
	SLO-2		*Analysis of anchorage zone stress – methods (names only)*			
S-7	SLO-1	*Strength concept - examples*	*Indian standard method of analysis of anchorage zone stresses*	*Examples*	*TORSION ANALYSIS* *Shear stress due to torsion - circular – rectangle – T –section and box section.*	*Design of simple flat slab*
	SLO-2					
S-8	SLO-1	*Load balancing concept – cable profile – reaction – equivalent loads.*	*Examples*	*DESIGN OF TENSION MEMBER* *Determination of area of concrete*	*Examples*	*Example*
	SLO-2			*Load factor – cracking and collapse*		
S-9	SLO-1	*Load balancing concept – examples.*	*Design of anchorage zone.*	*Example*	*Examples*	*Example*
	SLO-2		*Example*			

Learning Resources	1. *Krishnaraju .R, "Prestressed Concrete", Tata McGraw-Hill Education, Edition: 2018, NewDelhi.* 2. *Pandit .G.S, Gupta .S.P, "Prestressed Concrete", CBS Publishers & Distributors, 2008* 3. *S. Ramamrutham, "Prestressed Concrete", DhanpatRai Publishing Company, Fifth Edition, Reprint 2016*	4. *Lin T.Y, Design of, "Prestressed Concrete Structures", Asia Publishing House, Bombay 1995.* 5. *IS: 1343-2012 "IS Code of Practice for Prestressed Concrete", BIS, New Delhi, 2012.* 6. *NPTEL Course: Prestressed Concrete Structures: https://nptel.ac.in/courses/105106117/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. G.Hariharanath, GA Consultants, Chennai, gac1996@hotmail.com	*1. Dr. R. Santhakumar, Professor, Centre for Rulal Department, NITTTR*	*1. Dr. K. Gunasekaran, SRMIST*
2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. P. Jayabalan, NIT, Trichy, pjeya@nitt.edu*	*2. Dr. P. R. Kannan Rajkumar, SRMIST*

Course Code	18CEE307T	Course Name	DESIGN OF EARTHQUAKE RESISTANT STRUCTURES	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*IS 1893 (Part 1):2016, IS 13920 : 2016*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	*Understand the principles of structural dynamics with regard to Single Degree Of Freedom (SDOF) system.*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-2 :	*Extension of understanding of SDOF system to Multi Degree Of Freedom System (MDOF) with emphasis on two degree of freedom system.*																		
CLR-3 :	*Understand the fundamentals of earthquake forces.*																		
CLR-4 :	*Apply structural dynamics principles to the analysis of structures subjected to earthquake forces.*																		
CLR-5 :	*Design earthquake resistant moment resistant frames / shear walls with emphasis on ductile detailing.*																		
CLR-6 :	*Understand the modern concepts in the design of earthquake resistant structures using isolation techniques.*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*Analyze single degree moment resistant frame for free and forced vibrations*	*3*	*80*	*80*	*H*	*H*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*-*	*-*
CLO-2 :	*Analyze two degree moment resistant frame for free vibrations using modal superposition method*	*3*	*75*	*75*	*H*	*H*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*-*	*-*
CLO-3 :	*Calculate base shear using equivalent static method as per IS 1893*	*3*	*90*	*85*	*H*	*H*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*L*	*H*	*-*	*-*
CLO-4 :	*Calculate base shear using response spectrum method as per IS 1893*	*3*	*85*	*80*	*H*	*H*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*L*	*H*	*-*	*-*
CLO-5 :	*Apply the provisions of IS13920 to structures*	*3*	*90*	*80*	*H*	*M*	*M*	*M*	*-*	*-*	*L*	*-*	*-*	*-*	*-*	*L*	*H*	*-*	*-*
CLO-6 :	*Suggest isolation systems for earthquake resistance*	*3*	*75*	*75*	*H*	*L*	*L*	*L*	*-*	*-*	*L*	*-*	*-*	*-*	*-*	*-*	*M*	*-*	*-*

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*SINGLE DEGREE OF FREEDOM SYSTEM (SDOF) Introduction to Systems with single degree of freedom*	*MULTI-DEGREE OF FREEDOM SYSTEM (MDOF) Introduction to Systems with two degrees of freedom*	*DESIGN SEISMIC FORCES AS PER IS 1893-2016 Basis of earthquakes – epicenter*	*DUCTILE DESIGN FOR EARTHQUAKE RESISTANCE USING IS 13920-2016 Definition of ductility – member and structural*	*BASE ISOLATION Introduction to base isolation*
	SLO-2	*Definition of free vibration – mass, stiffness,*	*Introduction to Systems with multi degrees of freedom (MDOF)*	*Magnitude of earthquake – measurement – Richter's scale*	*Response reduction factor and ductility*	*Passive base isolation – introduction*
S-2	SLO-1	*Damped and undamped vibration*	*Moment resistant frames as MDOF– two degree freedom system*	*Intensity of earthquake – different scales*	*General specification for ductility*	*Base isolation for a building*
	SLO-2	*Fundamental / Natural frequency and time period – problem solving*	*Shear building and lumped mass*	*Configurations of buildings to resist earthquake*	*Ductile requirements of beams – general*	*Purpose of base isolation*
S-3	SLO-1	*Forced vibration –Harmonic loading*	*Calculation of column stiffness – effect of orientation of column on stiffness*	*Vertical and in-plan mass irregularities*	*Ductile requirements of beams – Longitudinal reinforcement*	*Principles of base isolation*
	SLO-2	*Derivation of equation of motion for free and forced vibration*	*Computation of diagonal mass matrix*	*Vertical and in-plan stiffness irregularities – calculation of eccentricities in plan*	*Ductile requirements of beams – Transverse reinforcement*	*Basic requirements of base isolation system*
S-4	SLO-1	*Solution of equation of motion for free vibration*	*Computation of stiffness matrix*	*Storey drift and storey shear*	*Ductile requirements of columns – geometry*	*Type of Base Isolation Systems – Elastomeric rubber bearings – Roller and ball bearings,*
	SLO-2	*Solution of equation of motion for forced vibration – harmonic loading*	*Forming acceleration and velocity vectors*	*Response spectrum*	*Relative strength of columns and beams at a joint*	
S-5	SLO-1	*Problem solving for finding the response for undamped free vibration*	*Equation of motion of undamped two degree lumped mass free vibration of moment resistant frame*	*Seismic zone factor, Importance factor,*	*Transverse reinforcement in column*	*Type of Base Isolation Systems – springs – sliding bearing*

	SLO-2	*Problem solving for finding the response for damped free vibration*	*Solution of equation of motion of undamped two degree freedom system for free vibration*	*Response reduction factor*	*Ductile detailing for shear walls – introduction*	*Modeliing base isolation in SAP – introduction*
S-6	SLO-1	*Problem solving for finding the response for undamped forced vibration*	*Eigen value problem and modal superposition method*	*Percentage of imposed loads , seismic weight of floors- Load combinations*	*General requirements*	*Input requirements for SAP*
	SLO-2	*Problem solving for finding the response for damped forced vibration*	*Determining modal frequencies and time periods*	*Introduction to Equivalent Static Method (ESM) and its limitations*	*Design for shear force*	*Input requirements for ETABS*
S-7	SLO-1	*Magnification factor*	*Uncoupled equations in SDOF and finding modal response*	*Computation of base shear for single & double storey moment resistant plane frame using ESM*	*Design for axial force*	*Modeling for base isolation in STAAD.Pro*
	SLO-2	*Application to determine the forces transferred to base from machine foundation*	*Undamped equation of motion for two degree moment resistant frame with lateral harmonic loading at the DOF*	*Introduction to Response Spectrum Method(RSM) and applicability*	*Design for bending moment*	*Input requirements for STAAD.Pro*
S-8	SLO-1	*Machine isolation*	*Modal superposition method to form uncoupled SDOF equations including modal load vector.*	*Computation of base shear for single storey and double storey moment resistant plane frame using RSM*	*Opening in walls – introduction*	*Introduction to active base isolation*
	SLO-2	*Determination of damping required to minimize forces transferred to foundation*	*Determination of response of the structure at discrete time intervals.*	*Introduction to DBE (Design Based Earthquake) and MCE(Maximum Considered Earthquake)*	*Detailing around the openings*	*Underlying principles of active base isolation*
S-9	SLO-1	*Definition of ground motion due to earthquake*	*Superposition of modal responses*	*Performance based design – Capacity and demand spectra as per ATC40*	*Ductile construction joints*	*Schematic diagram of a typical active base isolation system*
	SLO-2	*Equivalent model for considering ground motion in moment resistant fame*	*Square Root of Sum of Squares (SRSS) method.*	*Principles of pushover analysis and pushover curve*	*Ductile design of gravity columns in buildings*	*Comparison between passive and active base isolation*

Learning Resources	1. *Anil K.Chopra, "Dynamics of structures" (Theory and Applications to Earthquake Engineering), 5th Edition, Pearson, 2016* 2. *Short course on "Seismic design of reinforced concrete buildings", CEP, IIT, Kanpur, 2005.*	3. *IS 1893: 2016, (Part I) "Criteria for Earthquake Resistant Design of Structures - Part 1: General Provisions and Buildings", BIS, 2016.* 4. *IS 13920: 2016,"Ductile design and detailing of reinforced concrete structures subjected to seismic forces - Code of practice", BIS, 2016.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*40 %*	-	*40 %*	-	*10 %*	-	*40%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*70 %*	-	*55%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*20 %*	-	*20 %*	-	*20 %*	-	*5%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. S. Dhanabal, General Manager, NLY, Neyveli, dhans1960@yahoo.co.in	*1. Dr. R. Santhakumar, Professor, Centre for Rulal Department, NITTTR*	*Prof. G. Augustine Maniraj Pandian, SRMIST*
2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. P. Jayabalan, NIT, Trichy, pjeya@nitt.edu*	*Dr. K.S. Satyanarayanan, SRMIST*

Course Code	18CEE308T	Course Name	DESIGN OF STEEL-CONCRETE COMPOSITE STRUCTURES	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book/Codes/Standards	*IS 456 :2000, IS 800: 2007, IS 11384, Steel Tables*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand the concept of steel-concrete composite member design and to get introduced to the relevant IS codes*
CLR-2 :	*Create insights to the concepts of Limit state method of design*
CLR-3 :	*Utilize the concepts in performing design of steel-concrete composite beams and columns*
CLR-4 :	*Utilize the concepts in performing design of steel-concrete composite connections*
CLR-5 :	*Understand the behaviour of composite girder bridges*
CLR-6 :	*Create insights to the seismic behaviour of composite structures*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Identify the effect of external loads on steel-concrete composite members and the factors influencing their behaviour and to get familiarity with the relevant IS codes*	*2*	*85*	*80*	*H*	-	-	*M*	-	-	-	-	-	-	-	*H*	*H*	*M*	-
CLO-2 :	*Analyze the behavior of steel-concrete composite sections under flexure, shear and compression*	*2*	*85*	*80*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	*H*	*H*	*M*	-
CLO-3 :	*Apply Limit state method of design to steel-concrete composite beams and columns*	*2*	*80*	*75*	*H*	*H*	*H*	*H*	-	-	-	-	-	-	-	*H*	*H*	*M*	-
CLO-4 :	*Apply Limit state method of design to steel-concrete composite connections*	*2*	*80*	*75*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	*H*	*H*	*M*	-
CLO-5 :	*Analyze the behavior of steel-concrete composite girder bridges*	*2*	*80*	*75*	*H*	-	-	*M*	-	-	-	-	-	-	-	*H*	*H*	*M*	-
CLO-6 :	*Analyze the seismic behaviour of composite structures*	*2*	*85*	*80*	*H*	*H*	*H*	*H*	-	-	-	-	-	-	-	*H*	*H*	*M*	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*INTRODUCTION Introduction to Steel - Concrete Composite Construction-Advantages-Limitations*	*Design Example 1*	*Design Example 3*	*Design Example 1*	*SEISMIC BEHAVIOUR OF STEEL-CONCRETE COMPOSITE STRUCTURES Introduction*
	SLO-2	*Materials to be used-Structural advantages-Factors deciding selection of materials*	*Design Example 1*	*DESIGN OF CONNECTIONS Introduction*	*Design Example 1*	*Basic concepts*
S-2	SLO-1	*Introduction to steel - concrete composite codes/standards*	*Design Example 2*	*Types of Connections*	*Design Example 2*	*General design criteria*
	SLO-2	*Limitations of using BIS codes-Introduction to Eurocode 4*	*Design Example 2*	*Choice of Connections in Composite structures*	*Design Example 2*	*General design criteria*
S-3	SLO-1	*Theory of composite structures*	*Design Example 2*	*Behaviour of Connections in Composite structures*	*DESIGN OF STEEL-CONCRETE COMPOSITE GIRDER BRIDGES Introduction*	*Code provisions*
	SLO-2	*Behaviour of composite beams*	*Design Example 2*	*Basic concepts*	*Behaviour of girder bridges*	*Seismic behaviour of composite beams*
S-4	SLO-1	*Behaviour of composite beams*	*Design of Composite Columns*	*Code provisions*	*Behaviour of girder bridges*	*Seismic behaviour of composite beams*
	SLO-2	*Behaviour of composite columns*	*Design Procedure*	*Design procedure*	*Design concepts*	*Seismic behaviour of composite slabs*
S-5	SLO-1	*Behaviour of composite columns*	*Relevant BIS code provisions*	*Design Example 1*	*Design concepts*	*Seismic behaviour of composite slabs*

	SLO-2	*Limit state method of design of steel-concrete composite sections under flexure-code provisions*	*Choice of cross-sections*	*Design Example 1*	*Materials to be used-Types of cross-sections*	*Seismic behaviour of composite columns*
S-6	SLO-1	*Limit state method of design of steel-concrete composite sections under shear- code provisions*	*Design Example 1*	*Design Example 2*	*Basic design considerations*	*Seismic behaviour of composite columns*
	SLO-2	*Limit state method of design of steel-concrete composite sections under compression- code provisions*	*Design Example 1*	*Design Example 2*	*Basic design considerations*	*Seismic behaviour of composite connections*
S-7	SLO-1	*DESIGN OF STEEL-CONCRETE COMPOSITE MEMBERS* *Design of Composite beams*	*Design Example 1*	*Design Example 3*	*Failure types*	*Seismic behaviour of composite connections*
	SLO-2	*Design Procedure*	*Design Example 2*	*Design Example 3*	*Failure types*	*Seismic behaviour of composite frames*
S-8	SLO-1	*Relevant BIS code provisions*	*Design Example 2*	*Design of Shear Connections*	*Relevant code provisions*	*Seismic behaviour of composite frames*
	SLO-2	*Choice of cross-sections*	*Design Example 2*	*Basic concepts*	*Mandatory checks*	*Seismic behaviour of composite frames*
S-9	SLO-1	*Design Example 1*	*Design Example 3*	*Code provisions*	*Comparison with conventional bridge types*	*Design methods*
	SLO-2	*Design Example 1*	*Design Example 3*	*Design procedure*	*Comparison with conventional bridge types*	*Design methods*

Learning Resources	1. *"Teaching Resource Material for Structural Steel Design", Volume 2/3 jointly prepared by 1. I.I.T., MS 2. Anna University 3. SERC, MS 4. "Institute for Steel Development and growth", Calcutta.* 2. *Owens .G.W, & Knowels.P. "Steel Designs Manual", (sixth Edition) Steel Concrete Institute (UK) Oxford Black; well Scientific Publications, 2003.*	3. *Johnson.R.P, "Composite Structures of Steel and Concrete". Vol-I, # Oxford Black; well Scientific Publications (Third Edition) U.K. 2004.* 4. *Subramanian.N, Design of Reinforced Concrete Structures, Oxford University Press New Delhi, 2013* 5. *Subramanian.N, Design of Steel structures-Limit state method, Oxford University Press New Delhi, 2016*

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3(15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
Level 2	Apply Analyze	*50%*	-	*50%*	-	*50%*	-	*50%*	-	*60%*	-
Level 3	Evaluate Create	*20%*	-	*20%*	-	*20%*	-	*20%*	-	*10%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Mini-Projects

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. G.Hariharanath, GA Consultants, Chennai, gac1996@hotmail.com	*1. Dr. R. Santhakumar, Professor, Centre for Rulal Department, NITTTR*	*Prof.G.Augustine Maniraj Pandian, SRMIST*
2. Er. AGV. Desigan, Design Group Engineering Consultancy Pvt Ltd. Chennai, desigan.agv@gmail.com	*2. Dr. P. Jayabalan, NIT, Trichy, pjeya@nitt.edu*	*Prof. N.Umamaheswari, SRMIST*

Course Code	18CEE309T	Course Name	GEOGRAPHIC INFORMATION SYSTEM	Course Category	E	*Professional Elective Course*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*CIVIL ENGINEERING*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Introduce to mapping techniques*
CLR-2 :	*Identification of the data and DBMS*
CLR-3 :	*Interpretation and analysis of GIS Data*
CLR-4 :	*perform various GIS analysis*
CLR-5 :	*Understand the Digital elevation Model*
CLR-6 :	*Apply the knowledge of GIS*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	*2*	*3*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*understand the GIS, background, Development of and Components of GIS*	*2*	*85*	*80*	*H*	-	-	-	-	-	-	-	*L*	-	-	*H*	*H*	-	-
CLO-2 :	*study the data capturing techniques in GIS & Database management*	*2*	*85*	*75*	*H*	-	-	-	-	-	-	-	*M*	-	-	*H*	*H*	-	-
CLO-3 :	*analyze various spatial and Non-spatial Data*	*2*	*80*	*75*	*H*	-	*M*	*M*	*H*	-	*H*	-	*M*	-	-	*H*	*H*	-	-
CLO-4 :	*Generation of various thematic*	*2*	*85*	*80*	*H*	*H*	*M*	*M*	*H*	-	*H*	-	*M*	-	-	*H*	*H*	-	-
CLO-5 :	*study the Generation and Application of DEM*	*2*	*85*	*75*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	-	*M*	-	-	*H*	*H*	-	-
CLO-6 :	*appreciate the applications of GISI*	*2*	*80*	*75*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	-	*M*	-	-	*H*	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction & Définition*	*Data and Information*	*Data Analysis*	*Digital elevation model*	*Applications of GIS*
	SLO-2	*GIS in civil engineering*	*Data and data types*	*Spatial data analysis*	*DTM,DSM,*	*GIS in resource mapping*
S-2	SLO-1	*Historical background*	*Spatial data*	*Buffering-point, Line and polygon bufferin*	*DEM -Data requirement*	*Land use and Land cover Analysis*
	SLO-2	*Concept of Development*	*Nonspatial data*	*Over lay –Point on polygon*	*Sources of DEM*	*Ground water Studies*
S-3	SLO-1	*Qualifications of GIS*	*Spatial data-raster data*	*Over lay –Line on polygon*	*Generation of DTM*	*Groundwater potential mapping and Artificial recharge suitability mapping*
	SLO-2	*Requirement of GIS*	*Spatial data-vector data*	*Over lay –Polygon on polygon*	*Generation of TIN*	*Runoff modeling*
S-4	SLO-1	*Elements of GIS*	*Merits and demerits of Raster data*	*Raster Over lay analysis*	*Generation of DEM*	*Forest mapping, Agricultural Studies-Crop yiel estimation, acreage production etc*
	SLO-2	*Cartography*	*Merits and demerits of Vector data*	*Vector Over lay analysis*	*Parameters of DEM analysis*	*Disaster management studies-natural and artificial disasters*
S-5	SLO-1	*Digital cartography*	*Data input methods*	*Network analysis-Alternate route analysis*	*Applications of DEM*	*Flood and earthquake studies,*
	SLO-2	*Symbolization & Generalization*	*Data input methods- Digitization*	*Shortest path and proximity analysis*	*Slope and aspect*	*Drought management*
S6	SLO-1	*Map and definition of Map*	*Data input methods -Scanning*	*Reclassification*	*Use of EDM for Hydrological studies*	*Other disaster related studies*
	SLO-2	*Types of Map*	*Data input methods-Keyboard entry*	*Non-Spatial data Analysis - Query -object based and field based analysis*	*Groundwater studies*	*Wetland management,*
S-7	SLO-1	*Classification of Map Based on Scale*	*Data Output methods*	*Data Manipulation, Data Generalization*	*Site suitability for construction of Dam and Reservoir*	*Urban and Regional planning*

	SLO-2	*Classification of Map Based on purpose and Theme*	*Data Output methods-Soft copy output*	*Data Abundance and Data Redundancy*	*Consideration for Construction of Irrigation structure*	*Smart city mapping*
S-8	SLO-1	*Map Analysis*	*Data Output methods-Hard copy output*	*Data Retrieval-RDBMS*	*DEMs in site suitability for solar and wind energy generation*	*Smart Transportation systems*
	SLO-2	*Coordinate systems*	*Software modules ArcGIS, -Arcinfo, Arc Toolbox*	*Record modeling In GIS*	*DEMs in disaster studies-Flood Hazard Mapping,,*	*Solid Waste management using GIS*
S-9	SLO-1	*Projection systems*	*ArcEdit, ArcMap, Arc catalog*	*Expert System-Artificial Intelligence*	*Landslide studies, Avalanches studies*	*Water qualitystudies*
	SLO-2	*Coordinate systems used in India*	*QGIS, and other open source softwares*	*Artificial Neural Networking*	*limitations of DEM*	*Soilmoisturestudies*

Learning Resources	1. Anji Reddy .M, "Remote sensing and Geographical information system",B.S Publications, 2011. 2. Chestern, "Geo Informational Systems - Application of GIS and Related Spatial Information Technologies », ASTER Publication Co., 1992. *3.* Jeffrey Star and John Estes, "Geographical Information System - An Introduction", Prentice Hall, 1990.	4. Burrough .P.A, "Principles of GIS for Land Resources Assessment", Oxford Publication,1980 5. SatheeshGopi, "Global Positioning System - Principles and Applications," Tata McGrawHill Publishing Company Limited, New Delhi (India), 2005 *6. NPTEL: Course – GIS in Civil Engineering :* https://nptel.ac.in/courses/105102015/8

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*50%*	-	*40%*	-	*40%*	-	*45%*	-	*70%*	-
	Understand										
Level 2	Apply	*50%*	-	*60%*	-	*60%*	-	*55%*	-	*30%*	-
	Analyze										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. Sarunjith K J, Scientist, NCSCM	*Dr. S.G.D. Sridhar, University of Madras*	*Dr. Sachikanta Nanda, SRMIST*
Dr. Nagasundaram M, Geological Survey of India, nagasundaram.m@gsi.gov.in	*Dr. Nisha Radha Krishnan, NIT TRichy*	*Dr. R Annadurai, SRMIST*

Course Code	18CEE310T	Course Name	SOLID AND HAZARDOUS WASTE MANAGEMENT	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Create insights to the various sources and classification of solid and hazardous waste*
CLR-2 :	*Address concepts related to waste characteristics and source reduction*
CLR-3 :	*Create insights to the storage, collection and transport of waste*
CLR-4 :	*Address concepts related to waste processing technologies*
CLR-5 :	*Address concepts related to waste disposal*
CLR-6 :	*Role of Government and NGO's in sustaining the waste management*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Understand the various sources of solid and hazardous waste*	*2*	*85*	*80*	*H*	*H*	*M*	*L*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-2 :	*Able to identify the options for Reduction, reuse and recycling of waste*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-3 :	*Knowledge of collection and transport of solid and hazardous waste*	*2*	*80*	*75*	*H*	*H*	*M*	*M*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-4 :	*Able to know about various waste processing techniques*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-5 :	*Understand the waste disposal methods and management*	*2*	*85*	*80*	*H*	*H*	*M*	*M*	*L*	*L*	*M*	-	-	-	-	*L*	*M*	-	-
CLO-6 :	*Knowledge of basic solid and hazardous waste legislations*	*2*	*80*	*75*	*H*	*H*	*M*	-	-	*L*	*M*	-	-	-	-	-	*M*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Sources, classification and regulatory framework: Sources of solid waste*	*Waste characterization and source reduction: Waste generation rates*	*Storage, collection and transport of waste: Handling of waste at source*	*Waste processing technologies: Objectives of waste processing*	*Waste disposal : Waste disposal options for solid and hazardous waste*
	SLO-2	*Types of solid waste*	*Waste generation variation*	*Segregation of waste at source*	*material separation technologies in solid waste*	*Disposal in landfills*
S-2	SLO-1	*Hazardous Waste - Identification*	*sampling and characterization*	*Storage of municipal solid waste*	*Physical Processing Equipment*	*Landfill Classification*
	SLO-2	*Hazardous Waste -Classification*	*factors affecting waste generation rate and Composition*	*On-site storage methods*	*material processing technologies*	*Landfill types*
S-3	SLO-1	*Need for solid waste management*	*Physical properties of solid waste*	*Effect of storage*	*chemical conversion technologies*	*Landfill methods*
	SLO-2	*Need for hazardous waste management*	*Chemical properties of solid waste*	*Materials used for containers*	*biological conversion technologies methods of Composting*	*Site selection*
S-4	SLO-1	*Elements of integrated waste management*	*Biological properties of solid waste*	*Collection of municipal solid waste-Methods*	*biological conversion technologies methods of Composting*	*Design and operation of sanitary landfills*
	SLO-2	*roles of stakeholder's*	*Hazardous Characteristics*	*Collection vehicles – Manpower – Collection routes*	*Factors of Composting*	*Landfill liners*
S-5	SLO-1	*Role of public and NGO's*	*TCLP tests*	*Analysis of Collection systems*	*Thermal conversion technologies-energy recovery*	*Secure landfills*
	SLO-2	*Tutorial 1: Case Study: Status of Waste Generation in Bangalore*	*Tutorial 3 : Practices in household waste management*	*Solving problems using Tutorial Sheet 7*	*Thermal conversion technologies- energy recovery*	*Landfill bioreactors*

S-6	SLO-1	*Public health and environmental impacts*	*Tutorial 4: Source Reduction and Recycling.*	*Need for transfer and transport*	*Incineration*	*Leachate management*
	SLO-2	*Salient features of Indian legislations on management and handling of municipal solid waste*	*Source reduction of waste*	*Transfer stations*	*Hazardous Waste Treatment*	*Landfill gas management*
S-7	SLO-1	*Hazardous waste*	*Waste exchange*	*Hazardous Waste-Storage and collection*	*Physical and chemical treatment*	*Landfill closure*
	SLO-2	*Biomedical waste*	*Extended producer responsibility*	*Hazardous Waste-Storage and collection*	*Thermal treatment*	*Environmental monitoring*
S-8	SLO-1	*Lead acid batteries*	*Recycling*	*Hazardous Waste -Transfer and transport*	*Biological treatment*	*Rehabilitation of open dumps*
	SLO-2	*Electronic waste*	*Reuse*	*Hazardous Waste -Transfer and transport*	*Pollution Prevention and Waste Minimization*	*Landfill remediation*
S-9	SLO-1	*Plastics and fly ash*	*Solving problems using Tutorial Sheet 5*	*Hazardous waste manifests*	*Hazardous Wastes Management in India*	*Solving problems using Tutorial Sheet 9*
	SLO-2	*Tutorial 2: Mention the public awareness program*	*Solving problems using Tutorial Sheet 6*	*Hazardous waste transport*	*Solving problems using Tutorial Sheet 8*	*Solving problems using Tutorial Sheet 10*

Learning Resources	1. *George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill International edition, New York, 1993.* 2. *Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001.*	3. *CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.* 4. *NPTEL Course-Municipal solid waste management : https://nptel.ac.in/courses/120108005/* 5. *NPTEL Course-Solid and Hazardous waste management : https://nptel.ac.in/courses/105106056/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*60%*	-	*60%*	-	*60%*	-	*60%*	-	*60%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conference Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	18CEE311T	Course Name	AIR AND NOISE POLLUTION AND CONTROL	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Create insights to the various sources ofair quality*
CLR-2 :	*Address concepts related to modeling of atmospheric pollutants*
CLR-3 :	*Create insights to the air and noise pollution monitoring techniques*
CLR-4 :	*Address concepts related to reduce air pollution*
CLR-5 :	*Address concepts related to reduce noise pollution*
CLR-6 :	*Role of Government and NGO's in sustaining the air pollution at the source*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Understand the various sources of air and noise pollution*	*2*	*85*	*80*	*H*	*H*	*M*	*L*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-2 :	*Able to analyze air quality parameters*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-3 :	*Knowledge of atmospheric transport models for air pollutants*	*2*	*80*	*75*	*H*	*H*	*M*	*M*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-4 :	*Able to identify techniques to reduce noise pollution*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-5 :	*Apply the concept of reducing air and noise pollution*	*2*	*85*	*80*	*H*	*H*	*M*	*M*	*L*	*L*	*M*	-	-	-	-	*L*	*M*	-	-
CLO-6 :	*Knowledge of basic environmental legislations related to air and noise pollution*	*2*	*80*	*75*	*H*	*H*	*M*	-	-	*L*	*M*	-	-	-	-	-	*M*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction*	*Sources, classification and effects*	*Sampling and Meteorology*	*Air Pollution Control Measures*	*Noise pollutionand its control*
	SLO-2	*Air pollutants, Sources, classification,*	*Ambient air quality and emission standards*	*Ambient air sampling*	*Basics of pollution control*	*Basics of acoustics and specification of sound;*
S-2	SLO-1	*Monitoring techniques for air and noise pollution*	*Air pollution indices.*	*pollution measurement methods,*	*Control equipments –*	*sound power, sound intensity and sound pressure levels;*
	SLO-2	*Combustion Processes and pollutant emission,*	*Natural sources*	*principles and instruments*	*Particulate control methods*	*plane, point and line sources, multiple sources;*
S-3	SLO-1	*Air Act, legislation and regulations*	*Type of air pollutants*	*Monitoring stations in India*	*settling chambers,*	*outdoor and indoor noise propagation;*
	SLO-2	*Air quality management in India.*	*Effects on Health, vegetation-*	*temperature lapse rate and stability*	*cyclone separation,*	*psychoacoustics and noise criteria,*
S-4	SLO-1	*Greenhouse effect.*	*-materials and atmosphere*	*Adiabatic lapse rate*	*Wet collectors*	*effects of noise on health, annoyance rating schemes;*
	SLO-2	*Urban heat island*	*Reactions of pollutants in the atmosphere and their effects*	*Wind Rose, Inversion*	*fabric filters*	*special noise environments*
S-5	SLO-1	*Major contributions of air pollutant*	*-Smoke, smog and ozone*	*Wind velocity and turbulence*	*electrostatic precipitators*	*Infrasound, ultrasound, impulsive sound and sonic boom;*
	SLO-2	*Noise -What is Noise?*	*Layerdisturbance,*	*Plume behavior*	*Removal of gaseous pollutants by adsorption, absorption,*	
S-6	SLO-1	*Noise pollution,*	*Ambient noise quality and emission standards*	*Carbon emission*	*Biological air pollution control technologies,*	*noise standards and limit values;*
	SLO-2	*Sources, classification,*	*Noise pollution indices.*	*Noise sampling and Noise level meter*	*Indoor air quality*	*Occupational noise standard*

S-7	SLO-1	*Monitoring techniques for noise pollution*	*Manmade sources*	*Pollution measurement methods,*	*control principles*	*Noise instrumentation and monitoring procedure.*
	SLO-2	*Noise Act, legislation and regulations*	*Types of noise pollutant*	*Principles and instruments*	*Alternative*	*Noise indices.*
S-8	SLO-1	*Noise quality management in India.*	*Effects on Human Health and*	*Occupational noise monitoring*	*Case studies on Air pollution -1*	*Noise control methods*
	SLO-2	*Noise management in other countries*	*O0occupational exposure*	*Monitoring-case studies*	*Case studies on Air pollution -1*	*Case studies on Air pollution– 2*
S-9	SLO-1	*Solving problems using Tutorial Sheet 1*	*Solving problems using Tutorial Sheet 3*	*Tutorial hour-1*	*Tutorial hour-3*	*Case studies on noise pollution*
	SLO-2	*Solving problems using Tutorial Sheet 2*	*Solving problems using Tutorial Sheet 4*	*Tutorial hour-2*	*Tutorial hour-4*	*Case studies on noise pollution*

Learning Resources	1. *C. S. Rao, "Environmental Pollution Control Engineering", Wiley Eastern Limited, 2000.* 2. *M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 1993* 3. *Dr. Y. Anjaneyulu, "Air Pollution and Control Technologies", Allied publishers Pvt. Ltd., 2002.* 4. *Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition* 5. *Peterson and E.Gross Jr., "Hand Book of Noise Measurement", 5 th Edition, 1963*	6. *Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986* 7. *Antony Milne, "Noise Pollution: Impact and Counter Measures", David & Charles PLC, 1979.* 8. *Kenneth wark, Cecil F.Warner, "Air Pollution its Origin and Control", Harper and Row Publishers* 9. *NPTEL Online Course - Noise Management and Control : https://swayam.gov.in/nd1_noc19_me72/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*60%*	-	*60%*	-	*60%*	-	*60%*	-	*60%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Elvis Dsouza, EDPC Polymer Industries, Maharashtraelvisdsouza11@gmail.com	*Dr. Rehana Shaik, Assiatant Professor, Dept of Civil Engineering, IIIT Hyderbad rehanaiisc@gmail.com*	*Dr. Paromita Chakraborty, Research Assoc.Professor, SRMIST*
Dr.Rajkumar Director Hubert Envirocare Systems, Chennai rajkumar@hecs.in	*Dr. E.S.M Suresh Professor & Head Department of Civil Engineering NITTTR, Chennaiesmsuresh@gmail.com*	*Mr. S.Ramesh, Assist. Prof & Mr.K.C. Vinuprakash, Assist. Prof. SRMIST*

Course Code	18CEE312T	Course Name	ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Know the interrelationship between various activities and their impact on environment*
CLR-2 :	*Understand how to conduct an environmental impact assessment*
CLR-3 :	*Learn principles and methods of environmental analysis*
CLR-4 :	*review and comment on an environmental impact statement, environmental assessment and environmental regulations*
CLR-5 :	*Understand role of standards and how government, NGOs, and the private sector can affect their evolution*
CLR-6 :	*Explain the concept of life cycle assessment (LCA) as an environmental management tool and its potential for identifying all the environmental impacts throughout the entire life cycle of a product*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Explainkey concepts in environmental impact assessment & Management*	*3*	*85*	*80*	*H*	-	-	-	-	-	*H*	*H*	-	-	-	-	*M*	-	-
CLO-2 :	*Understand the importance of various rules & regulation in EIA*	*2*	*85*	*75*	-	*M*	-	-	-	*M*	*H*	-	-	-	-	-	*M*	-	-
CLO-3 :	*Evaluate the Impact on various environments and role of stake holders in EIA*	*2*	*80*	*75*	*H*	*M*	-	*M*	-	*M*	*M*	-	-	-	-	-	*M*	-	-
CLO-4 :	*Explain the application of Life cycle analysis*	*2*	*85*	*75*	*H*	*M*	-	-	-	*H*	*H*	*M*	-	-	-	-	*M*	-	-
CLO-5 :	*Identify most suitable tool for assessment process and make suggestions for solutions*	*2*	*85*	*80*	*H*	*H*	-	*M*	*M*	-	*M*	*M*	-	-	-	-	*M*	-	-
CLO-6 :	*Participate in a group to evaluate a project using EIA & LCA using one or more management tools*	*2*	*80*	*75*	*H*	*H*	-	*M*	-	-	*H*	-	*H*	-	-	-	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction Introduction, definitions and concepts of EIA, Ethics and environment, EIA for civil engineers*	*Evolution of EIA Evolution of EIA worldwide; Evolution of EIA in India; Forecasting Environmental Changes*	*Assessment Technique Components of the Environment: Water- Standards pertaining to water quality*	*Life Cycle Analysis Life cycle assessment and its purpose; Evolution of Life Cycle Assessment; Stages in LCA of a Product; A Code of Good Conduct for LCA*	*EIA Methodologies Initial Environmental Examination; Screening*
	SLO-2	*Discussion: Identify the Ethics that you breach in daily activities which affects the environment*	*Discussion: Introduction to importance of Rio Convention*	*Activity & Discussion using a Case Study*	*Discussion: Necessary for LCA*	*Case Study involving screening*
S-2	SLO-1	*Ecology and the environment ; Ecosystem and its characteristics*	*Types of EIA: Rapid; Comprehensive; Strategic; Sectoral; Regional Rationale and scope of each type*	*Components of the Environment: Air & Noise- Standards pertaining to Air & Noise quality*	*Procedures for LCA; Defining the goal and scope; Analyzing the inventory; Assessing environmental impact*	*Scoping Analysis of alternatives*
	SLO-2	*In continuation with previous class discussion in how the ecosystem in which you live gets affected your activities*	*Case Study*	*Activity & Discussion using a Case Study*	*Case Study using LCA*	*Case Study in EIA*
S-3	SLO-1	*Structure of Ecosystem; Biotic Components Abiotic components*	*EIA Regulations in India Overview of Indian laws – Constitutional Provisions (Water, Air, Forest, Hazardous etc)*	*Components of the Environment: Soil- Soil quality, Landuse Criteria*	*Carbon trading: Energy foot printing, Food foot printing and Carbon foot printing.*	*Mitigation- Definition, options for mitigation of impact on water, air and land, water, energy, flora and fauna*
	SLO-2	*Identify the impact of your activities on Biotic and abiotic components of your ecosystem& How their services gets affected*	*Discussion: Evolution of law with time*	*Activity & Discussion using a Case Study*	*Case Study On carbon footprint*	*Case study Employing mitigation measures*

S-4	SLO-1	*Food chains, Food webs and Tropic levels*	*EPA 1986*	*Components of the Environment: Biosphere (Macro, Micro)- Introduction to Hazard Exposure levels for biota*	*Environmental management: Principles, problems and strategies; Review of political, ecological and remedial actions.*	*Environmental Impact Statement- Document planning - collection and organization of relevant information*
	SLO-2	*Identify the impact of your activities on various trophic levels of your ecosystem*	*Discussion: Amendment of E(P) Rules, 1986 on time of 545 days for finalisation of Draft Notification (MOEFCC Website)*	*Activity & Discussion using a Case Study*	*Discussion With Activity: Why Environmental Management is important – using case study*	*Example: Case study with Documentation*
S-5	SLO-1	*Energy and energy flows; Elemental cycles,*	*EIA Notification 2006*	*Components of the Environment: Socio-economic*	*Environmental audit: Definitions,concepts, partial audit, compliance audit, methods & regulations.*	*ToR& Sectoral ToR*
	SLO-2	*Choose a element cycle and how it affects the ecosystem*	*Case Study*	*Activity & Discussion using a Case Study*	*Discussion: Introduction to ISO 19011 (EMS Auditing)*	*Example of ToR for various environments*
S-6	SLO-1	*Concept of Succession;Role of succession in restoration and recovery of ecosystem*	*CPCB and State PCBs – roles and responsibilities*	*Components of the Environment: Cultural and Aesthetics*	*Local infrastructure development and environmental management: A system approach, Regional environmental management system Landuse Conversion plan development and implementation strategies*	*Environmental Assessment- Base line, Construction Phase, Post Construction/ Operational phase scenario*
	SLO-2	*Example: Restoration of an ecosystem (Mining area)*	*Discussion: Sethusamudram Project- Role of CPCB& SPCB and Central & State Governments*	*Activity & Discussion using a Case Study*	*Discussion: Problems faced in developmental projects- using case study*	*Case study on a project*
S-7	SLO-1	*Ecosystem disturbances and their causes; natural causes and anthropogenic causes*	*Structured Environmental Management Systems ISO 14001 - EMS*	*Role of Public Participation in EIA*	*Environmental management systems in local government. Certification body assessments of EMS Documentation for EMS*	*Impact Assessment Methodologies: Checklists- Simple, Descriptive, Scaling Checklist*
	SLO-2	*Discussion: How Do Species Replace One Another in Ecological Succession?*	*Case Study: (Whitelaw and Butterworth, ISO 14001: Environmental System Handbook, 1997)*	*Reference EIA Notification 2006*	*Discussion: Expert systems (Software/ Model) used for EMS*	*Case study involving Checklist methods*
S-8	SLO-1	*Ecosystem and Ecological Footprints*	*ISO 18001- OHSAS*	*Role of stakeholders*	*Sustainable development – Definitions, Charter and Global Conventions; Future scenarios.*	*Matrix- Simple, Interaction- Leopold Matrix, Stepped matrix*
	SLO-2	*Discussion: How Cultural Changes Have Increased Our Ecological Footprints?*	*Discussion: Accreditation Procedure for ISO 14001*	*Activity & Discussion using a Case Study, Role Play*	*Discussion on various important conventions*	*Case study involving Matrix methods Discussion: Aldo Leopold's Environmental Ethics*
S-9	SLO-1	*Discussion of basic concepts*	*Environmental Risk Assessment*	*Setting the baseline*	*Case Studies on EIA*	*Network Methods Decision Tree, Expert Systems*
	SLO-2	*Example: Case study (An Affected Area)*	*Discussion: risk screening/prioritization*	*Discussion-Describe the various aspects of the environmental components of your neighborhood*	*Case Studies on EIA*	*Case study involving Network methods Introduction to various Expert system (Software/ models widely used)*

Learning Resources	*1 .L. W. Canter, Environmental Impact Assessment, 2nd Ed., McGraw-Hill, 1997.* *2. G. Burke, B. R. Singh and L. Theodore, Handbook of Environmental Management and Technology, 2nd Ed., John Wiley & Sons, 2000* *3. R. Therivel, John Glasson, Andrew Chadwick, Introduction to Environmental Impact Assessment (Natural and Built Environment), Routledge, 2005.* *4. K. Whitelaw and Butterworth, ISO 14001: Environmental System Handbook, 1997*	*5. H. Scott Matthews, Chris T. Hendrickson, and Deanna Matthews, Life Cycle Assessment: Quantitative Approaches for Decisions that Matter, 2014. Open access textbook, retrieved from https://www.lcatextbook.com/* *6. NPTEL Course - Environmental Management: https://nptel.ac.in/courses/120108004/16#* *7. NPTEL Course - Environmental Impact Assessment : https://nptel.ac.in/syllabus/105103024/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*60%*	-	*60%*	-	*60%*	-	*60%*	-	*60%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	18CEE313T	Course Name	DESIGN OF HYDRAULIC STRUCTURES AND IRRIGATION ENGINEERING	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Provide knowledge on irrigation and its types, and on water movement through soil*
CLR-2 :	*Expound on the design principles of gravity and earthen dams and associated structures*
CLR-3 :	*Introduce diversion structures and their design by applying failure concepts*
CLR-4 :	*Provide an understanding of canal structures*
CLR-5 :	*Address concepts on sediment movement*
CLR-6 :	*Introduce design concepts for various types of canals*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Acquire knowledge on soil–plant–water relationship*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Complete a design for dams and spillways*	*2*	*85*	*75*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Understand the types of diversion structures and design them by applying failure concepts*	*2*	*85*	*75*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-4 :	*Identify the various canal structures and design them*	*2*	*85*	*80*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-5 :	*Understand basic concepts of sediment movement*	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-6 :	*Design various types of canals considering efficiency and economy*	*2*	*85*	*75*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Irrigation: Necessity and importance of irrigation*	*Lane's weighted creep theory*	*Earthen dams – types*	*Canal falls – necessity and location of falls*	*Computing the design capacity of an irrigation canal*
	SLO-2	*Methods of irrigation*	*Design of a vertical drop weir on Bligh's creep theory*	*Design of earthen dams*	*Types of canal falls*	*Shield's entrainment method*
S-2	SLO-1	*Methods of improving soil fertility*	*Design of a vertical drop weir on Bligh's creep theory*	*Design of earthen dams*	*Design of a trapezoidal notch fall*	*Design of non-scouring stable channels with protected side slopes in alluvium soil (Shield's entrainment method)*
	SLO-2	*Standards of quality for irrigation water*	*Khosla's method – flow nets*	*Seepage analysis in earthen dams*	*Design of a trapezoidal notch fall*	*Design of non-scouring stable channels with protected side slopes in alluvium soil (Shield's entrainment method)*
S-3	SLO-1	*Duty and delta – factors affecting duty*	*Khosla's method of independent variables for determination of pressures and exit gradient for seepage below a weir or a barrage*	*Seepage analysis in earthen dams*	*Design of simple vertical drop fall*	*Design of non-scouring channels with unprotected side slopes in alluvium soil*
	SLO-2	*Methods of improving duty*	*Design problem on Khosla's method of independent variables*	*Design for stability of earthen dams*	*Design of simple vertical drop fall*	*Design of non-scouring channels with unprotected side slopes in alluvium soil*
S-4	SLO-1	*Irrigation efficiencies*	*Design problem on Khosla's method of independent variables*	*Design for stability of earthen dams*	*Design of a Sarda fall*	*Design of most efficient channel section*

	SLO-2	*Problems in irrigation efficiencies*	*Complete design of weir/barrage using Khosla's theory*	*Spillways – types and design considerations*	*Design of a Sarda fall*	*Design of most efficient channel section*
S-5	SLO-1	*Estimation of consumptive use –Blaney Criddle method*	*Complete design of weir/barrage using Khosla's theory*	*Design of chute spillway*	*Cross drainage works – types*	*Design of stable channels – Kennedy's theory*
	SLO-2	*Pan evaporation method – Penman's method*	*Storage structures: Gravity dam – cross section of gravity dam*	*Design of chute spillway*	*Cross drainage works – selection of suitable type*	*Design of stable channels – Kennedy's theory*
S-6	SLO-1	*Classes and availability of soil water – soil moisture deficiency*	*Modes of failure of gravity dam*	*Design of ogee spillway*	*Design considerations for cross drainage works*	*Design of stable channels – Lacey's theory*
	SLO-2	*Depth of water stored in root zone*	*Criteria for structural stability of gravity dam*	*Design of ogee spillway*	*Design considerations for cross drainage works*	*Design of stable channels – Lacey's theory*
S-7	SLO-1	*Limiting soil moisture conditions*	*Design considerations for gravity dam*	*Energy dissipators*	*Design of cross drainage works*	*Balancing depth of canals*
	SLO-2	*Depth and frequency of irrigation*	*Design considerations for gravity dam*	*Design of stilling basin*	*Design of cross drainage works*	*Balancing depth of canals*
S-8	SLO-1	*Diversion structures: Weirs and barrages*	*Design of gravity dam*	*Canal structures: Canal regulators – head and cross regulator*	*Design of cross drainage works*	*Economic justification of canal lining for unlined canals*
	SLO-2	*Diversion head works and its components*	*Design of gravity dam*	*Functions – Alignment of the off-taking channel*	*Design of cross drainage works*	*Economic justification of canal lining for unlined canals*
S-9	SLO-1	*Failure of hydraulic structures – failure by piping and failure by direct uplift*	*Design of gravity dam*	*Design of cross regulator*	*Conveyance: Mechanics of sediment transport*	*Design of lined canals*
	SLO-2	*Bligh's creep theory*	*Design of gravity dam*	*Design of distributary head regulator*	*Computing the design capacity of an irrigation canal*	*Design of lined canals*

Learning Resources	1. *Santhosh Kumar Garg, "Irrigation Engineering and Hydraulic Structures",Khanna Publishers, 2000.* 2. *Punmia B.C. et al., "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2009* 3. *AsawaG. L., "Irrigation and Water Resources Engineering", New Age International Publishers, New Delhi, 2005.*	4. *SharmaR.K., "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing Company, New Delhi, 2002* 5. *NPTEL – Irrigation and Drainage:https://nptel.ac.in/courses/126105010/* 6. *NPTEL – Water Resources Engineering: https://nptel.ac.in/downloads/105105110/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Abdul Hakeem, National Remote Sensing Center, Hyderabad, abdulhakeem_k@nrsc.gov.in	*1. Dr. Rehana Shaik, IIIT, Hyderabad, rehana.s@iiit.ac.in*	*1. Dr. DeepthaThattai, SRMIST*
2. Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru, sat@satyukt.com	*2. Dr. S. Saravanan, NIT Trichy, saravanans@nitt.edu*	*2. Dr. R. Sathyanathan, SRMIST*

Course Code	18CEE314T	Course Name	GROUND WATER ENGINEERING	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book/Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Create insights into the occurrence and properties of groundwater*
CLR-2 :	*Address concepts related to movement of groundwater*
CLR-3 :	*Create insights on well hydraulics*
CLR-4 :	*Address concepts related to exploration and investigation of groundwater*
CLR-5 :	*Create insights into groundwater management and seawater intrusion*
CLR-6 :	*Understand the software applications in groundwater modeling*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Understand the various properties of groundwater*	*2*	*85*	*80*	*H*	*M*	*L*	*L*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-2 :	*Understand the governing equations of groundwater movement*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-3 :	*Acquire the knowledge on yield of the well and its hydraulics*	*2*	*80*	*75*	*H*	*H*	*M*	*M*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-4 :	*Understand the concept of various methods of exploration*	*2*	*85*	*75*	*H*	*L*	*M*	*M*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-5 :	*Understand the concept of seawater intrusion and conjunctive use*	*2*	*85*	*80*	*H*	*M*	*H*	*H*	-	*M*	*M*	-	-	-	-	*L*	*M*	-	-
CLO-6 :	*Acquire knowledge on groundwater modeling and models in use*	*2*	*80*	*75*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	-	-	-	-	*H*	*M*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction to Groundwater: Global distribution of water, role of groundwater in hydrological cycle*	*Groundwater Movement Groundwater Movement- Governing Equation*	*Well Hydraulics Flow into a well*	*Subsurface Exploration Objective and Need for exploration Various methods*	*Groundwater Management and Modeling Groundwater quality and Contamination*
	SLO-2	*Various water bearing formations, subsurface water distribution*	*Darcy's Law*	*Steady radial flow into a well: Dupuit equation, Thiem's equation*	*Geophysical investigations*	*Groundwater quality standards*
S-2	SLO-1	*Aquifers and types of aquifers*	*Heterogeneity and anisotropy*	*Unsteady radial flow into a well: Theis equation*	*Surface geophysical techniques*	*Types and sources of groundwater contamination*
	SLO-2	*Aquifer properties: porosity, permeability, specific yield, storage coefficient and transmissivity, factors affecting permeability*	*Estimation of aquifer parameters*	*Jacob's correction for very thin aquifers with water table condition*	*Electrical resistivity method*	*Various quality parameters and its significance*
S-3	SLO-1	*Problems on aquifer properties*	*Problems on Darcy's law*	*Problems on Theis equation*	*Seismic refraction method*	*Attenuation of groundwater quality*
	SLO-2	*Problems on aquifer properties*	*Problems on aquifer parameter estimation*	*Problems on Jacob equation*	*Remote sensing in groundwater exploration*	*Potential evaluation of groundwater quality*
S-4	SLO-1	*Groundwater fluctuation*	*1D governing equation of flow through porous medium*	*Theis recovery, well hydraulics*	*Other surveying methods*	*Physical, chemical and biological method of analysis*
	SLO-2	*Groundwater balance and budgeting*	*2D governing equation of flow through porous medium*	*Wells in leaky aquifer*	*Borehole geophysical techniques*	*Problems on quality evaluation*

S-5	SLO-1	*Problems on water balance equation*	*Equation for flow into leaky aquifer*	*Partially penetrating wells*	*Electric logging, radioactive logging*	*Conjunctive use of groundwater and basin management*
	SLO-2	*Problems on groundwater fluctuation*	*Flow through unconfined aquifer*	*Image well theory, multiple wells*	*Induction, fluid and sonic logging*	*Groundwater development under various scales*
S-6	SLO-1	*Groundwater in different rocks*	*Boundary conditions*	*Well capacity and well development*	*Geochemical method of exploration*	*Groundwater modeling, problems in groundwater*
	SLO-2	*Groundwater potential in India*	*Groundwater flow rates and direction*	*Construction and types of open well*	*Application of GIS in groundwater exploration*	*Types of models*
S-7	SLO-1	*Case Study 1*	*Groundwater flow problems*	*Construction and types of tube well*	*Seawater intrusion theory*	*Conceptual model, physical model*
	SLO-2	*Case Study 2*	*Steady one dimensional flow, flow into galleries*	*Problems on well hydraulics*	*Shape of interface*	*Mathematical model and analog model*
S-8	SLO-1	*GEC Norms*	*Aquifer with recharge*	*Problems on Theis recovery*	*Slope of interface*	*Data, input, boundary conditions and output, prediction*
	SLO-2	*Methodology of estimation*	*flow into confined aquifer with constant*	*Pumping test and recuperation test*	*Causes of seawater intrusion*	*Calibration and validation of a model*
S-9	SLO-1	*Status of groundwater in various parts of India- a case study*	*flow into confined aquifer with variable thickness*	*Problems on yield test*	*Effects of seawater intrusion*	*Groundwater models*
	SLO-2	*Threats to groundwater*	*Groundwater Theory, Solution for differential Equations*	*Well losses and determination*	*Various methods of reducing seawater intrusion*	*MODFLOW, MT3D, FEFLOW, SEAWAT*

Learning Resources	*1. Raghunath, H. M., "Ground Water", New Age International (P) Ltd, 2014.* *2. D.K. Todd and L. F. Mays, "Groundwater Hydrology", John Wiley and Sons.* *3. K. R. Karanth, "Hydrogeology", Tata McGraw Hill Publishing Company.*	*4. NPTEL course - Ground Water Hydrology: http://nptel.ac.in/courses/105105042/* *5. NPTEL course - Ground Water Hydrology: http://nptel.ac.in/courses/105103026/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
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2. Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru, sat@satyukt.com	*2. Dr. S. Saravanan, NIT Trichy, saravanans@nitt.edu*	*2. Ms. T. Saranya, SRMIST*

Course Code	18CEE315T	Course Name	SURFACE HYDROLOGY	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Create insights into various hydrometeorological variables and components of hydrological cycle*			
CLR-2 :	*Address concepts related to precipitation and water losses*			
CLR-3 :	*Analyze concepts of runoff and hydrograph analysis*			
CLR-4 :	*Address concepts related to floods and their estimation*			
CLR-5 :	*Create insights into reservoir routing and stream flow routing*			
CLR-6 :	*Address various types of models and their processes*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*Identify various hydrometeorological variables and components of hydrological cycle*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Analyze precipitation and water losses*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Understand runoff and hydrograph analysis*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-4 :	*Analyze floods and their estimation*	*2*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-5 :	*Understand reservoir routing and channel routing*	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-6 :	*Analyze various models and their processes*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Weather and climate*	*Precipitation: forms and types*	*Runoff, components of stream flow*	*Floods: Standard project flood, maximum probable flood, PMP, design flood*	*Systems and models – system concept in hydrology*
	SLO-2	*Scope of hydrometeorology*	*Test for consistency of the record, causes of inconsistency in the record*	*Catchment characteristics, watershed concepts*	*Estimation of peak flood: Empirical flood formulae- Dickens, Ryves, Inglis, Myers*	*Types of models – physical, conceptual, empirical, mathematical models*
S-2	SLO-1	*Meteorological variables*	*Double mass curve techniques*	*Classification of streams, isochrones*	*Rational method and concentration time method*	*Life cycle of a model*
	SLO-2	*Temperature, atmospheric pressure*	*Depth-Area relationship, Intensity-Duration-Frequency (IDF) curves*	*Factors affecting runoff*	*Problems on peak discharge*	*Types of mathematical models*
S-3	SLO-1	*Atmospheric humidity*	*Analysis of rainfall data*	*Runoff estimation: rational method, assumptions and drawbacks*	*Flood frequency studies: California method and Weibull method*	*Formulation of a mathematical model – modeling concepts*
	SLO-2	*Simple problems on saturation vapour pressure and relative humidity*	*Problems on mean, median and mode, mass curve, hyetograph, moving average, IDF and frequency curve*	*Components of streamflow hydrograph*	*Problems on flood frequency*	*Watershed–System concept*
S-4	SLO-1	*Clouds: categories and its classification*	*Design storm*	*Baseflow separation methods*	*Encounter probability: probability of exceedance and Probability of non-exceedance*	*Types of watershed models*
	SLO-2	*Atmosphere: different strata of atmosphere*	*Water losses*	*Problems on rainfall excess estimation by baseflow separation methods*	*Problems on encounter probability*	*Models in practice for various hydrologic processes*

S-5	SLO-1	*Wind and wind belts*	*Evaporation from water surfaces, Dalton's law of evaporation*	*Derivation of a unit hydrograph*	*Flood routing: Reservoir routing and channel routing*	*Stochastic model: space independent and space co-related*
	SLO-2	*Evaporation, vertical air motions*	*Evaporation pans: floating pans, land pan and Colorado sunken pan*	*Elements and propositions of unit hydrograph*	*Reservoir routing: ISD method*	*Artificial Neural Network (ANN)*
S-6	SLO-1	*Global distribution of water*	*Pan coefficient, problems on loss of water due to evaporation*	*Problems on unit hydrograph*	*Modified Pul's method*	*ANN activation function*
	SLO-2	*Water resources of India*	*Measures to reduce lake evaporation*	*Problems on unit hydrograph*	*Problem on reservoir routing*	*Network training algorithm – back propagation*
S-7	SLO-1	*Seasons in India*	*Transpiration, transpiration ratio and evapotranspiration*	*S-curve method*	*Problem on reservoir routing*	*Advantages and limitations of ANN*
	SLO-2	*Hydrology and hydrologic cycle*	*Consumptive use determination by Blaney-Criddle method, problems.*	*Problems on S-curve hydrograph*	*Stream flow routing: prism storage and wedge storage*	*Fuzzy sets and fuzzy logic*
S-8	SLO-1	*Distribution of rainfall in India*	*Infiltration, Horton's equation*	*Problems on S-curve hydrograph*	*Muskingum method*	*Fuzzification, evaluation of rules, defuzzification*
	SLO-2	*Scope of hydrology*	*Measurement of infiltration: infiltrometer and rainfall simulator*	*Synthetic unit hydrograph*	*Problem on Muskingum method*	*Fuzzy rule based reservoir operation model*
S-9	SLO-1	*Hydrological data*	*Infiltration indices: phi index and W-index*	*Snyder's method*	*Problem on Muskingum method*	*Changes in climate as related to water*
	SLO-2	*Hydrologic equation, simple problems on water budget.*	*Problems on Horton's equation and infiltration indices*	*Problems on Snyder's method*	*Flood forecasting and warning*	*Impacts and responses – climate change and water resources*

Learning Resources	1. *Raghunath, H.M., Hydrology, New Age International Publishers, New Delhi, 2007.* 2. *Subramanya, K., Engineering Hydrology, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2014* 3. *Pukh Raj Rakhecha and Vijay P. Singh, Applied Hydrometeorology, Capital Publishing Company, 2009.* 4. *Chow, V.T., and Maidment, Hydrology for Engineers, McGraw Hill Inc., Ltd., 2000* 5. *Vedula, S., and Mujamdar, P.P., Water Resources Systems, McGraw Hill Inc., 2005*	6. *NPTEL Course – Advanced Hydrology: https://nptel.ac.in/courses/105101002/#* 7. *Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 2008: Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp.* 8. *NPTEL course – Watershed Management: https://nptel.ac.in/courses/105101010/16*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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2. Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru, sat@satyukt.com	*2. Dr. S. Saravanan, NIT Trichy, saravanans@nitt.edu*	*2. Dr. Deeptha Thattai, SRMIST*

Course Code	18CEE401T	Course Name	PAVEMENT ANALYSIS AND DESIGN	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Learn layered structure stress-strain analysis*
CLR-2 :	*Understand the viscoelastic characterization of the material*
CLR-3 :	*To impart basic knowledge on various bituminous technology and its characterization*
CLR-4 :	*Familiarize with the design of flexible pavement*
CLR-5 :	*Study about the distress of pavements*
CLR-6 :	*Knowabout the pavement condition survey*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*analyze the critical conditions of the layered structure*	*2*	*85*	*80*	*H*	*H*	*M*	*L*	*H*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*M*	*-*	*-*
CLO-2 :	*Predict the real time behavior of the material*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	*-*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*M*	*-*	*-*
CLO-3 :	*Select appropriate material for the bituminous pavement construction*	*2*	*80*	*75*	*H*	*H*	*M*	*M*	*-*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*M*	*-*	*-*
CLO-4 :	*Design the flexible pavement for different conditions of traffic and with different material combination*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	*-*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*M*	*-*	*-*
CLO-5 :	*Evaluate the existing condition of the pavement*	*2*	*85*	*80*	*H*	*H*	*M*	*M*	*L*	*-*	*M*	*-*	*-*	*-*	*-*	*-*	*M*	*-*	*-*
CLO-6 :	*Suggest the suitable measures to improve the condition of the pavement*	*2*	*80*	*75*	*H*	*H*	*M*	*-*	*-*	*-*	*M*	*-*	*-*	*-*	*-*	*-*	*M*	*-*	*-*

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Stress Analysis of Layered Structure: Importance of pavement design*	*Viscoelasticity: Introduction to viscoelasticity*	*Pavement Materials: Bitumen.*	*Design of Flexible pavement: Different layers of flexible pavement*	*Evaluation of pavement: Distress in flexible pavement*
	SLO-2	*Overview of layered system*	*Creep and recovery*	*Modified bitumen*	*Design factors*	*Distress in flexible pavement*
S-2	SLO-1	*Single layer system- stress analysis*	*Stress relaxation*	*Bitumen emulsion-Types*	*Traffic factors*	*Distress of rigid pavement*
	SLO-2	*Single layer system- stress analysis*	*Viscoelastic models*	*Grading of bitumen*	*Traffic factors*	*Distress of rigid pavement*
S-3	SLO-1	*Solving problems*	*Viscoelastic solid model*	*Performance grading*	*Material characteristics*	*Evaluation of distress*
	SLO-2	*Solving problems*	*Derivation of Voigt-Kelvin model*	*Aging of binder*	*Temperature*	*Distress measurement-Surface roughness*
S-4	SLO-1	*Two-layer pavement- stress analysis*	*Creep and recovery response of Voigt-Kelvin model*	*Bituminous mixture*	*Critical locations in pavement*	*Skid resistance*
	SLO-2	*Two-layer pavement- stress analysis*	*Stress relaxation response of Voigt-Kelvin model*	*Hot mix asphalt mixture*	*Pavement design as per IRC*	*Deflection measurements*
S-5	SLO-1	*Solving problems*	*Viscoelastic fluid model*	*Warm mix asphalt mixture*	*Solving problems-VDF*	*Benkelman beam test - concept*
	SLO-2	*Solving problems*	*Derivation of Maxwell model*	*Half warm mix asphalt mixture*	*Solving problems-VDF*	*Benkelman beam test – Method of measuring deflection*
S-6	SLO-1	*Multilayered stress analysis*	*Creep and recovery response of Maxwell model*	*Cold mix asphalt mixture*	*Solving problems-Pavement Design*	*Falling weight deflectometer-Working principle*
	SLO-2	*Multilayered stress analysis*	*Stress relaxation response of Maxwell model*	*Cold mix asphalt mixture*	*Solving problems-Pavement Design*	*Fallingweightdeflectometer-Calculation of moduli*
S-7	SLO-1	*Multilayered stress analysis*	*Burger's model*	*Mixture characterization - Resilient modulus*	*Solving problems-Pavement Design*	*Design of overlay by Benkelman beam method*

	SLO-2	*Multilayered stress analysis*	*Derivation of Burger's model*	*Mixture characterization - Determination of resilient modulus*	*Solving problems-Pavement Design*	*Design procedure*
S-8	SLO-1	*Software demo for multilayered structure*	*Oscillatory shearing*	*Mixture characterization - Dynamic modulus*	*Airfield pavement*	*Design procedure*
	SLO-2	*Software demo for multilayered structure*	*Response of elastic material to Oscillatory shearing*	*Mixture characterization - Determination of dynamic modulus*	*Specifications of airfield pavement*	*Solving problems*
S-9	SLO-1	*Software demo for multilayered structure*	*Response of viscous material to Oscillatory shearing*	*Mixture characterization - Time-temperature superposition*	*Design procedure of airfield pavement*	*Solving problems*
	SLO-2	*Software demo for multilayered structure*	*Response of viscoelastic material to Oscillatory shearing*	*Mixture characterization – Rutting and fatigue characterization*	*Design procedure of airfield pavement*	*Solving problems*

Learning Resources	1. *Yang Huang, Pavement Analysis and Design, Pearson, 2004* 2. *Chakroborthy and A. Das, Priciples of Transportation Engineering, Prentice-Hall of India,2003* 3. *S. K. Khanna, C.E.G. Justo and A. Veeraragavan, Highway Engineering, Revised 10th edition, Nem Chand &Bros., Roorkee, 2014.* 4. *Yoder,E.J., and Witczak, Principles of Pavement Design, 2nd ed.John Wiley and Sons, 1975.*	5. *Wineman, A.S. and Rajagopal, K. R, Mechanical Response Of Polymers: An Introduction, Cambridge University Press, 2000.* 6. *6.Guidelines for the Design of Flexible Pavements, IRC :37, The Indian Road Congress, New Delhi* 7. *Subash C, Saxena, Textbook of Highway and Traffic Engineering, CBS Publishers, 1st Edition,2014* 8. *NEPTEL link - https://nptel.ac.in/courses/105105107/1 and https://nptel.ac.in/courses/112104040/12 (as on 05.07.2019)*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

#CLA – 4 can be from any combination of Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conference Paper

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.com	*Dr. VenkaiahChowdary, Associate Professor, NITW, vc@nitw.ac.in*	*Dr. A. Padma Rekha, SRM IST*
Mr.AnkitPachouri, Transport Planner, IUT, New Delhi, ankit.pachouri@iutundia.org	*Dr. V Sunitha, Assistant Professor, NITT, sunitha@nitt.edu*	*Ms R Dhanya, SRM IST*

Course Code	18CEE402T	Course Name	RAILWAY, AIRPORT AND HARBOUR ENGINEERING	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Get exposed to Railway track planning and design*
CLR-2 :	*Understand the process of operation and maintenance of Railway track*
CLR-3 :	*Attain knowledge on the concepts of planning and design of airport components*
CLR-4 :	*Learn the structural design of the airfield pavement*
CLR-5 :	*Understand the process in the Evaluation of the airfield pavement*
CLR-6 :	*Acquire knowledge on the site characteristics and component planning for harbour*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Apply the planning and design concepts of railway alignment and geometric design of railway track*	*2*	*85*	*80*	*H*	*H*	*M*	*L*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-2 :	*Plan and design the operational facilities for effective rail transportation*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-3 :	*Apply the planning and design concepts of airport components*	*2*	*80*	*75*	*H*	*H*	*M*	*M*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-4 :	*Design the airfield pavement*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-5 :	*Evaluate the airfield pavement*	*2*	*85*	*80*	*H*	*H*	*M*	*M*	*L*	*L*	*M*	-	-	-	-	*L*	*M*	-	-
CLO-6 :	*Understand the basic need for handling the cargos in the harbour*	*2*	*80*	*75*	*H*	*H*	*M*	-	-	*L*	*M*	-	-	-	-	-	*M*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*RAILWAY PLANNING AND DESIGN Introduction to railway engineering*	*Numericals in length of transition curve*	*AIRPORT PLANNING AND GEOMETRIC DESIGN Importance and limitations Advantages and Limitations of Air Transport.*	*PAVEMENT DESIGN AND EVALUATION Importance of pavement design and evaluation*	*HARBOUR ENGINEERING Importance of Harbour Engineering*
	SLO-2	*Role of Indian Railways in National Development*	*Numericals in length of transition curve*	*Characteristics of Air travel.*	*Components of airfield pavement*	*History and modern trends of waterway transportation,*
S-2	SLO-1	*Track Alignment -Importance*	*Widening of Gauges in Curves , Gradients Grade Compensation*	*Airport Master Plan, Evaluation and Institutional arrangements*	*Wheel and Axle Configurations*	*Definition of Terms - Harbours, Ports, Docks, , Sounding,*
	SLO-2	*Obligatory points in railway track alignment*	*Vertical Curves*	*Site Selection and survey,*	*Traffic considerations*	*Tides and Waves, Sounding, Littoral Drift*
S-3	SLO-1	*Engineering Surveys for Track Alignment*	*RAILWAY TRACK OPERATION AND MAINTENANCE Points and Crossings -*	*Components of airport- Runway Orientation,*	*Stress and strain analysis in airfield pavement*	*Classification of Harbours*
	SLO-2	*Remote Sensing, GIS &GPS, EDM and other equipment*	*Turnouts – Types - Working Principle*	*Cross wind Component, Wind rose Diagram*	*Stress and strain analysis in airfield pavement*	*Site Selection and harbour planning*
S-4	SLO-1	*Permanent Way and its components*	*Signaling*	*Numericals in Type I and II Wind Rose Diagram*	*Numericals in stress and strain*	*Types of Layouts of ports and components*
	SLO-2	*Functions of each component -Concept of Gauges*	*Interlocking*	*Basic Runway length and Corrections*	*Numericals in stress and strain*	*Approach facilities- With head gates, Without head gates*

S-5	SLO-1	*Gauges and the type of gauges*	*Track Circuiting*	*Numericals in Corrections of BRL*	*Cummulative Damage Factor*	*Protection facilities*
	SLO-2	*Coning of Wheels, Creeps and kinks*	*Construction & Maintenance Materials,*	*Numericals in Corrections of BRL*	*Environmental factors*	*Breakwater and its types*
S-6	SLO-1	*Geometric Design of Railway Tracks - basic terms and representations*	*Track Drainage*	*Airport classification, Geometric design and specifications of runway*	*FAARFIELD input*	*Docking facilities*
	SLO-2	*Super-Elevation, Negative superelevation*	*Track Modernization*	*Geometric Design elements and specifications of taxiway*	*Design of airfield pavement using FAARFIELD*	*Wet docks and Dry docks*
S-7	SLO-1	*Numericals in design of superelevation*	*Automated maintenance and upgrading, Technologies,*	*Runway patterns - Minimum Separation Distances*	*Pavement Evaluation - importance*	*Navigational Aids - Buoys and Beacons*
	SLO-2	Numericals in design of superelevation	Re-laying of Track	Clearance over Highways and Railways	Method of evaluation and overview	Light ships, Light house
S-8	SLO-1	Numericals in design of superelevation	Lay outs of Railway Stations and Yards,	Drainage - Airport Zoning	Structural Evaluation - test procedure	Storage Facilities
	SLO-2	Numericals in design of superelevation	Rolling Stock	Aircraft parking systems	Structural Evaluation - evaluation techniques	Dolphins
S-9	SLO-1	Horizontal Curves, Transition Curves,	Tractive Power, Track Resistance	Visual Aids , Wind Direction Indicators	Functional Evaluation - test procedure	Mooring Accessories
	SLO-2	Numericals in length of transition curve	Numericals in Tractive resistance	Runway and Taxiway Markings and Lightings	Functional Evaluation - evaluation techniques	Dredging facilities

Learning Resources	1. *SaxenaSubhash C and Satyapal Arora, "A Course in Railway Engineering", DhanpatRai and Sons, Delhi, 1998.* 2. *Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee, 1994.* 3. *R Horonjeff and F X Mckelvy, Planning and design of Airport, Mc-Graw Hill International Editions, 1993*	4. *R. Srinivasan, "Harbour, Docks and Tunnel Engineering", Charotar Publishing home, 27th Edition, 2015* 5. *S P Bindra, "A Course in Docks and Harbour Engineering", DhanpatRai and Sons, NewDelhi, 1993.* 6. *NPTEL link - https://nptel.ac.in/courses/105107123/ (as on 05.07.2019)*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
Level 2	Apply Analyze	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
Level 3	Evaluate Create	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of Assignments, Seminars, Tech Talks, Mini Projects, Case Studies, Self Study, MOOCs, Certifications, Conference Paper

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.com	*Dr. VenkaiahChowdary, Associate Professor, NITW, vc@nitw.ac.in*	*Dr. A. Padma Rekha, SRM IST*
Mr.AnkitPachouri, Transport Planner, IUT, New Delhi, ankit.pachouri@iutundia.org	*Dr. V Sunitha, Assistant Professor, NITT, sunitha@nitt.edu*	*MsArunimaJayakumar, SRM IST*

Course Code	18CEE403T	Course Name	TRAFFIC ENGINEERING AND MANAGEMENT	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand the basics of traffic flow modelling.*
CLR-2 :	*Familiarize the microscopic modelling*
CLR-3 :	*Learn and understand the level of service of traffic flow*
CLR-4 :	*Address the issues related to flow interruptions*
CLR-5 :	*Learn and design the facilities required for the traffic control measures*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Develop model for the traffic stream parameters*	*2*	*85*	*80*	*H*	*H*	*M*	*L*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-2 :	*Create the microscopic models of the traffic flow*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-3 :	*Apply the qualitative rankings on uninterrupted flow*	*2*	*80*	*75*	*H*	*H*	*M*	*M*	-	*L*	*H*	-	-	-	-	*L*	*M*	-	-
CLO-4 :	*Provide the facilities for interrupted flow*	*2*	*85*	*75*	*H*	*H*	*H*	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-
CLO-5 :	*Apply the concept of traffic control measures*	*2*	*85*	*80*	*H*	*H*	*M*	*M*	*L*	*L*	*M*	-	-	-	-	*L*	*M*	-	-
		2	80	75	H	H	M	-	-	L	M	-	-	-	-	-	M	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*TRAFFIC STREAM MODELLING Importance of traffic Engineering and need for flow modelling*	*MICROSCOPIC TRAFFIC FLOW MODELLING Concepts of microscopic modeling*	*UNINTERRUPTED FLOW Concept of uninterrupted flow*	*INTERRUPTED FLOW Concept of interrupted flow - intersections*	*TRAFFIC CONTROL Various traffic control measures*
	SLO-2	*Importance of traffic Engineering and need for flow modelling*	*Car-following model, Basic terms and notations*	*Definitions - Capacity, Level of Service(LoS)*	*Various traffic measures for interrupted flow*	*Applications of control measures*
S-2	SLO-1	*Fundamental parameters - speed, density, volume,travel time,headway, spacing*	*Concept of stimulus - response*	*Highway capacity*	*Traffic signs*	*Traffic signal - elements*
	SLO-2	*Time-Space diagram*	*Application of stimulus response theory in traffic flow modelling*	*Factors affecting LoS*	*Types and specifications*	*Definition and analysis of saturation headway, saturation flow, lost time*
S-3	SLO-1	*Fundamental relations - time mean speed, space mean speed and their relation,*	*General motor's models*	*HCM methods*	*Road markings - longitudinal marking*	*Phase design - two, three, four phases*
	SLO-2	*Numerical problems and solutions*	*Derivation - general motor model*	*Urban Street - Classification*	*Road markings - transverse and object marking*	*Cycle time determination - Green split time*
S-4	SLO-1	*Relation between speeds, flow, density,*	*Simulation Problem in general motor model*	*Operational Performance measures*	*Channelization*	*Definitions and measurement of stopped and control delay*
	SLO-2	*Fundamental diagrams*	*Simulation Problem in general motor model*	*Congestion Management*	*Case studies*	*Webster's delay model*
S-5	SLO-1	*Greenshield's model – Assumptions and model form*	*Simulation Problem in general motor model*	*Case studies for congestion management*	*Traffic rotary*	*Problems in traffic signal design*
	SLO-2	*Derivation -greenshield model*	*Simulation Problem in general motor model*	*Case studies for congestion management*	*Conflict resolution in a rotary*	*Capacity and LoS analysis*

S-6	SLO-1	*Numerical solution - Greenshield model*	*Vehicle arrival model,Poisson distribution*	*Multilane highways - Characteristics, Capacity*	*Geometric layout*	*HCM 2000 method - analysis of a signalized intersections*
	SLO-2	*Numerical solution - Greenshield model*	*Problems in Poisson distribution*	*Multilane highways - Level of service*	*Design elements of rotary*	*Determination of level of service as per HCM 2000*
S-7	SLO-1	*Greenberg's logarithmicmodel*	*Headway modeling*	*Freeway operations*	*Capacity of rotary*	*Signal coordination- concepts*
	SLO-2	*Underwood's exponential model*	*Random vehicle generation*	*Freeway operations- operational considerations*	*Problem in rotary capacity*	*Application of coordinated traffic signal*
S-8	SLO-1	*pipe'sgeneralized model*	*Microscopic traffic simulation*	*Capacity and Level of service of freeway segment*	*Grade separated intersection - road over bridges*	*Concept of offset*
	SLO-2	*multi-regime models*	*Microscopic traffic simulation*	*Capacity and Level of service of freeway segment*	*Underpass, Overpass concepts*	*Common cycle length andbandwidth*
S-9	SLO-1	*Movingobserver method.*	*Design, calibration, validation, applications,*	*Weaving operation*	*Types of interchanges based on the traffic flow*	*Offset for one-way and two-way streets*
	SLO-2	*Numerical solution - moving observer method*	*Operational models.*	*Weaving operation*	*Case studies on interchanges*	*Vehicle actuated signals*

Learning Resources	1. *Roess, R. P. McShane, W. R. &Prassas, E. S. (1998), Traffic Engineering, Prentice – Hall.* 2. *May, A. D. (1990), "Fundamentals of Traffic Flow", second edn, Prentice Hall.* 3. *Papacostas, C. S. (1987), "Fundamentals of Transportation Engineering", Prentice-Hall, India*	4. *Kadiyali, L. R. (1987), "Traffic Engineering and Transportation Planning", KhannaPublishers, India.* 5. *Papacostas, C. S. and Prevedouros, P.D. (2001) "Transportation Engineering and Planning", Prentice Hall of India Pvt. Ltd.* 6. *Highway Capacity Manual (2010), Transportation Research Board, USA* 7. *NPTEL link - https://nptel.ac.in/downloads/105101008/# (as on 05.07.2019)*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of Assignments, Seminars, Tech Talks, Mini Projects, Case Studies, Self Study, MOOCs, Certifications, Conference Paper

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.com	*Dr. VenkaiahChowdary, Associate Professor, NITW, vc@nitw.ac.in*	*Dr. A. Padma Rekha, SRM IST*
Mr.AnkitPachouri, Transport Planner, IUT, New Delhi, ankit.pachouri@iutundia.org	*Dr. V Sunitha, Assistant Professor, NITT, sunitha@nitt.edu*	*Mr. G. Sivaprakash, SRM IST*

Course Code	18CEE404T	Course Name	CONSTRUCTION EQUIPMENT AND AUTOMATION	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Identify the management concepts of construction equipment*			
CLR-2 :	*Identify the various earthwork equipments and its applications in real projects*			
CLR-3 :	*Identify the various off shore equipments and techniques for dewatering*			
CLR-4 :	*Identify the various equipments used on aggregate and concrete production*			
CLR-5 :	*Analyze the basic concepts of methods and techniques on demolishing and dismantling structures*			
CLR-6 :	*Explore the advanced level of automated equipments for various construction activities*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Accrue the knowledge of equipment management and cost controlling methods*	*2*	*85*	*75*	*H*	*M*	-	*L*	-	-	-	*H*	*M*	*M*	*H*	*H*	*M*	-	*H*
CLO-2 :	*Apply the knowledge of calculating productivity of earthwork equipments*	*3*	*85*	*75*	*H*	*H*	-	*L*	*L*	-	-	-	*H*	*H*	*H*	*M*	*M*	-	*H*
CLO-3 :	*Accrue the knowledge of equipments used in off shore construction practice*	*2*	*85*	*75*	*H*	*H*	-	*M*	*M*	-	-	-	*H*	*H*	*H*	*M*	*M*	-	*H*
CLO-4 :	*Accrue the knowledge of equipments used for aggregate and concrete production, techniques for demolition*	*3*	*85*	*75*	*H*	*H*	-	*M*	*M*	-	-	-	*H*	*H*	*H*	*M*	*M*	-	*H*
CLO-5 :	*Apply the knowledge in demolition and dismantling the distressed structures*	*2*	*85*	*75*	*H*	*H*	-	*H*	*M*	-	-	-	*H*	*H*	*H*	*M*	*M*	-	*H*
CLO-6 :	*Accrue comprehensive knowledge of automation in construction practices*	*2*	*85*	*75*	*H*	*H*	-	*M*	*H*	-	-	-	*H*	*H*	*H*	*H*	*M*	-	*H*

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction on Construction Equipment*	*Earth Moving operations*	*Dredging equipment*	*Drilling equipments*	*Lifting equipments*
	SLO-2		*Types of Earthwork Equipment*	*Types of Dredging equipment*	*Types of Drilling equipments*	*Material handling equipments*
S-2	SLO-1	*Equipment Management in Construction Projects*	*Earthwork Equipment - Tractors*	*Types of trenching equipment*	*Principles of Blasting*	*Hoisting Equipments*
	SLO-2	*Management Programme*	*capacity calculations*		*Types of Blasting equipment*	*Types and safety precautions*
S-3	SLO-1	*Maintenance and Safety management*	*Earthwork Equipment - Motor Graders*	*Concept of Pipe jacking techniques*	*Aggregate production equipment*	*Slip form techniques*
	SLO-2	*Equipment requirement for construction project*	*Capacity calculations*	*Equipment used for Pipe jacking*	*Crushers*	
S-4	SLO-1	*Planning of Equipment*	*Earthwork Equipment - Scrapers,*	*Compaction equipments*	*Various types of crushers, feeders and screening equipments*	*Equipments for Conveyors*
	SLO-2	*Selection of Equipment*	*capacity calculations*	*Types of Compaction equipments*		*Types of Conveyors*
S-5	SLO-1	*Cost Control of Equipment*	*Earthwork Equipment - Front end Loaders*	*Pumping and Dewatering equipments*	*Concrete mixers*	*Prestressing techniques*
	SLO-2	*Depreciation on Equipment*	*capacity calculations*	*Types of pumps*	*Types of concrete mixers*	*Insitu prestressing in high rise structures*
S-6	SLO-1	*Conventional construction methods*	*Earthwork Equipment – Bull dozer*	*Well point Dewatering system*	*Pouring and pumping of concrete*	*Aerial transportations*
	SLO-2		*Capacity calculations*	*Vacuum dewatering of concrete flooring*	*Precautions*	*Applications and applications*
S-7	SLO-1	*Mechanized methods*	*Earthwork Equipment – Excavators*	*Pile Driving Equipments*	*Ready mix concrete - concept and procedure*	*Robots in construction*
	SLO-2	*Advanced Mechanized methods*	*Capacity calculations*	*Types and methods*		*Different automated equipments*
S-8	SLO-1	*Types of construction project*	*Equipments Used for Box Jacking Techniques*	*Concept of Coffer dam*	*Demolition equipment*	*Conventional plastering machines*
	SLO-2	*Types of construction equipment*		*Sheet piling*	*Controlled demolition techniques*	*Use of robots for repetitive activities*

S-9	SLO-1	*Safety Management*	*General safety in excavations*	*Tunneling equipments*	*Sequence of demolition*	*Drones in construction*
	SLO-2	*Safety measures*		*Methods of tunneling*	*Procedure for Dismantling*	*Advantages of drones*

Learning Resources	1. *Peurifoy, R.L., Ledbetter, W.B. and Schexnayder.C, "Construction Planning Equipment and Methods", McGraw Hill. Singapore 2005.* 2. *Sharma S.C. "Construction Equipment and Management", Khanna Publishers, Delhi, 2008.* 3. *Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers Delhi, 2008.*	4. *Mahesh Varma .Dr., "Construction Equipment and its planning and application", Metropolitan Book Company, New Delhi,2003.* 5. *https://nptel.ac.in/courses/105104161/12* 6. *https://nptel.ac.in/courses/105103023/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Mr. K. M. Nanthan, , L&T, RKMNNN@lntecc.com	*Dr. J. Saravanan, Annamalai University, ausjs5070@gmail.com*	*Mr. S. Prakashchander, SRMIST*

Course Code	18CEE405T	Course Name	CONTRACTS MANAGEMENT	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*To understand Indian Contract Act and to know the various types of construction contracts and their legal aspects*			
CLR-2 :	*Learn about contracts and agreements*			
CLR-3 :	*Acquire the knowledge of FIDIC concepts*			
CLR-4 :	*Apply the concept of various types of taxes*			
CLR-5 :	*Learn about the different types of labour laws*			
CLR-6 :	*Utilize the knowledge of labour laws and legal requirements in broader perspective*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Understanding the method of quoting the rates for bidding and tender process*	*3*	*85*	*75*
CLO-2 :	*Knowing the types of contracts*	*2*	*85*	*75*
CLO-3 :	*Steps involved in making contracts and records to be maintained in execution of contract*	*2*	*85*	*75*
CLO-4 :	*Knowledge in legal requirements in construction*	*2*	*85*	*75*
CLO-5 :	*Awareness of labour laws and Indian Contract Act*	*2*	*85*	*75*
CLO-6 :	*Acquiring knowledge to execute a contract*	*2*	*85*	*75*

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	*M*	-	-	-	*M*	-	*H*	*H*	*M*	*L*	*M*	*H*	-	*L*
H	*H*	-	-	-	*M*	-	*H*	*H*	*M*	*L*	*M*	*H*	-	*L*
H	*H*	-	-	-	*M*	-	*H*	*M*	*M*	*L*	*M*	*H*	-	*L*
H	*M*	-	-	-	*L*	-	*H*	*M*	*M*	*L*	*M*	*H*	-	*L*
H	*L*	-	-	-	*L*	-	*H*	*M*	*M*	*L*	*M*	*H*	-	*L*
H	*H*	-	-	-	*M*	-	*H*	*H*	*M*	*L*	*M*	*H*	-	*L*

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Indian contract act*	*Tender- Definitions and Methods*	*Construction claims: Extra items and causes of claims*	*Legal Requirements- Insurance and Bonding*	*Labour Regulations-social security*
	SLO-2	*Definitions and important terms. Clause 1-75*	*Need for tendering, agreements and bonds in tendering process*	*Types of construction claims, documentation*	*Types of insurance*	*Welfare legislation*
S-2	SLO-1	*Elements of contract*	*Notice inviting tender*	*Settlement of claims*	*Laws governing sale*	*Laws relating to wages, Bonus and industrial disputes*
	SLO-2	*Types of contract – Legal parlance, Engineering contracts*	*Tender- Prequalification process*	*Arbitration- comparison and action of laws*	*Purchase and sale of urban and rural land*	*Labour administration*
S-3	SLO-1	*Features and suitability*	*Bidding, Accepting*	*Agreements, subject matter*	*Land revenue codes*	*Insurance and safety regulations*
	SLO-2	*Design of contract documents*	*Evaluation of technical, contractual and commercial point of view*	*Causes of disputes and importance of role of various stakeholders in prevention of disputes*	*Tax laws- income tax, sales tax ,VAT*	*Workmen compensation act*
S4	SLO-1	*International contract document*	*One cover and two cover system*	*Alternate dispute resolution methods*	*Excise on custom duties and their influence on construction cost*	*Indian factory act*
	SLO-2	*Standard contract document*	*Contract formation and interpretation*	*Violations, Appointment of arbitrator*	*Legal requirements for planning*	*Child labour act*

S-5	SLO-1	*Importance of breach of contract*	*Potential contractual problems*	*Conditions of arbitrator Powers and duties of arbitrator*	*Property law, Agency law*	*Maternity act*
	SLO-2	*Law of torts*	*World bank procedures and guidelines*	*Rules of evidences*	*Local government laws for approval*	*Minimum wages act*
S-6	SLO-1	*Special and general conditions of contract*	*Tamilnadu transparency in tenders Act.*	*Dispute review boards*	*Statutory regulations*	*Payment of wages act,1936*
	SLO-2	*Introduction to FIDIC contracts and types*	*EMD, SD*	*Indian arbitration and conciliation act1996*	*The companies act 1956: nature and definition of a company*	*Industrial dispute act*
S-7	SLO-1	*ICE conditions- introduction*	*Environmental provisions for construction contracts*	*Difference between 1940 act and 1996 act*	*Registration and incorporation*	*Domestic engaging of misconduct*
	SLO-2	*Evaluation of FIDIC document, types*	*Duties and responsibilities- engineers and contractors, Project manager, owner*	*Extent application of 1996 act. objectives and general provisions*	*Memorandum of association*	*The Tamilnadu and country planning act*
S-8	SLO-1	*Design and build contract, EPC contract*	*Important site documents*	*Conciliation and its provisions in the act*	*Articles of association,, prospectus, kinds of company*	*Building and other construction works act,1996*
	SLO-2	*Short forms contract-colour code*	*Process of building permissions*	*Conduct of conciliation and arbitral proceedings, ground for challenge*	*Directors: powers, duties, meetings and winding up*	*Employees state insurance act,1948*
S -9	SLO-1	*Various conditions of red book*	*Provisions for scheduling delays and accelerations*	*Procedure of appeal against the awards.*	*Managing performance- introduction, monitoring and performance*	*Contract labour act,1970*
	SLO-2	*Case study*	*Case study*	*Case study*	*Case study*	*Case study*

Learning Resources	1. *John G. Betty., "Engineering Contracts", McGraw Hill,2003* 2. *Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", M. M. Tripathi Private Ltd., Bombay, 1982 Tamilnadu PWD Code, 2006.* 3. *Jimmie Hinze, "Construction Contracts", McGraw Hill, 2001*	4. *Joseph T. Bockrath, "Contracts, the Legal Environment for Engineers and Architects", McGraw Hill, 2000.* 5. *Lecture Notes, "Legal Aspects for Civil Engineers, Short Term Course organized by SRMEC", 29th May to 4th June, 2002.* 6. *https://nptel.ac.in/courses/105103093/11* 7. *https://nptel.ac.in/syllabus/105102013/*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40*	-	*30*	-	*40*	-	*30*	-	*40*	-
Level 2	Apply Analyze	*40*	-	*40*	-	*40*	-	*30*	-	*40*	-
Level 3	Evaluate Create	*20*	-	*30*	-	*20*	-	*40*	-	*20*	-
	Total	100 %		100 %		100 %		100 %		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Department coordinators
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Mr. Rajeev Srinivasan, , NASS Contacting, Rajeev.srinivasan@nasscontracting.com	*Dr. S. Kamal, University College of Engineering, Ramnad, kamalselva21@gmail.com*	*Mr. S. Anandh, SRM IST*

Course Code	18CEE406T	Course Name	REPAIR AND REHABILITATION OF STRUCTURES	Course Category	E	*Professional Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*To assess the diagnosis of distress*
CLR-2 :	*To provide an overview of performance of concrete structures*
CLR-3 :	*To identify the sources of dampness and its prevention remedies*
CLR-4 :	*To choose the appropriate material and its application*
CLR-5 :	*To assess the extent of distress*
CLR-6 :	*To study strengthening and demolition of structural component*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Diagnosis the distresses*	*3*	*85*	*75*	*H*	*H*	-	*M*	-	*H*	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Understand the performance of the concrete*	*3*	*85*	*75*	*H*	*H*	-	*M*	-	*H*	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Sources of dampness and its remedies can be able to identify*	*3*	*85*	*75*	*H*	*H*	-	*M*	-	*H*	-	-	-	-	-	-	*H*	-	-
CLO-4 :	*Know about types of materials and its selection*	*3*	*85*	*75*	*H*	*H*	-	*M*	-	*H*	*M*	-	-	-	-	-	*H*	-	-
CLO-5 :	*Rectify the Distress in various structures*	*3*	*85*	*75*	*H*	*H*	-	*M*	-	*H*	-	-	*H*	-	-	-	*H*	-	-
CLO-6 :	*Strengthen and demolish the structural components*	*3*	*85*	*75*	*H*	*H*	-	*M*	-	*H*	*M*	*M*	*H*	-	-	-	*H*	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*General Consideration – Distresses monitoring, Causes of distresses*	*Sources of dampness*	*Materials: Types*	*Distresses : Concrete Structures: Introduction, Causes of deterioration*	*General principle for Strengthening*
	SLO-2	*Defects due to climate, wear and erosion*	*Moisture movement from ground*	*Essential parameters for Materials*	*Diagnosis of causes, Flow charts for diagnosis*	*Relieving loads*
S-2	SLO-1	*Quality assurance & Inspection*	*DPC*	*Special Mortar And Concretes, Concrete Chemicals*	*Methods of repair – repairing, spalling and disintegration*	*Strengthening super structures*
	SLO-2	*Structural & Economic appraisal*	*Reasons for ineffective DPC*	*Special Cements*	*Repairing of concrete floors and pavements*	*Plating*
S-3	SLO-1	*Life Expectancy of Different Types of Buildings*	*Roof leakage - Pitched roofs*	*High Grade Concrete*	*Steel Structures : Types and causes for deterioration*	*Conversation to composite construction*
	SLO-2	*Influence of Environmental Elements on Buildings*	*Madras Terrace roofs*	*Expansive Cement*	*Types and causes for deterioration – preventive measures*	*Post stressing*
S-4	SLO-1	*Design and Construction Errors*	*Leakage of Concrete slabs*	*Polymer Concrete*	*Repair procedure - Brittle fracture*	*Jacketing*
	SLO-2	*Corrosion Mechanism*	*Protective Seal coatings*	*Epoxies, Resins*	*Lamellar tearing*	*Bonded overlays*
S-5	SLO-1	*Effect of Biological Agents*	*Ferro cement overlay*	*Surface Coatings*	*Defects in welded joints*	*Reinforcement addition*
	SLO-2	*Termite Control and Prevention*	*Resin or polymer slurry injection*	*Parameters & types of coatings*	*Mechanism of corrosion*	*Fiber wrap techniques*
S-6	SLO-1	*Chemical Attack on Building*	*Thin polymer overlay*	*Sulphur Infiltrated Concrete*	*Design of protect against corrosion*	*Pre placed aggregate concrete*
	SLO-2	*Aspects of Fire on Buildings*	*Thin epoxy overlay*	*Properties and application of SIFCON*	*Design and fabrication errors*	*Shortcrete*

S-7	SLO-1	*Building Cracks Causes – diagnosis*	*Dampness in solid walls*	*Ferro cement*	*Distress during erection.*	*Strengthening concrete by surface impregnations*
	SLO-2	*Remedial measures*	*Condensation – hygroscopic salts*	*Application of Ferro cement*	*Masonry Structures: Discoloration and weakening of stones*	*Vacuum methods*
S-8	SLO-1	*Thermal cracks*	*Remedial treatments*	*Fiber Reinforced Concrete*	*Biotical treatments*	*Strengthening the substructures: Shoring*
	SLO-2	*Shrinkage cracks*	*Dry pack & epoxy bonded dry pack*	*Types and applications*	*Preservation – Chemical preservatives*	*Under pinning*
S-9	SLO-1	*Vegetation and trees*	*Chemical coating*	*Admixtures*	*Brick masonry structures*	*Increasing the load capacity of footing*
	SLO-2	*Foundation movements*	*Flexible and rigid coatings*	*Chemical and Mineral admixtures*	*Distresses and remedial measures.*	*Design for rehabilitation.*

Learning Resources	1. *"Handbook on repair and rehabilitation of RCC buildings", CPWD, Government of India, Government of India Press, India, 2011* 2. *Allen R.T and Edwards S.C, "Repair of Concrete Structures", Blakie and Sons, UK, 1987* 3. *Dayaratnam.P and Rao.R, "Maintenance and Durability of Concrete Structures", University Press, India, 1997.* 4. *Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical, UK, 1991.*	5. *Dodge Woodson.R,"Concrete Structures – protection, repair and rehabilitation", Elsevier Butterworth – Heinmann, UK, 2009.* 6. *Peter H.Emmons, "Concrete Repair and Maintenance Illustrated", Galgotia Publications Pvt. Ltd., 2001.* 7. *Raikar, R.N., "Learning from failures - Deficiencies in Design, Construction and Service" – Rand D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.* 8. *https://onlinecourses-archive.nptel.ac.in/noc19_mm06/preview*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
Level 2	Apply Analyze	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
Level 3	Evaluate Create	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	18CEE407T	Course Name	SUSTAINABLE CONSTRUCTION METHODS	Course Category	E	Professional Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	**Co-requisite Courses**	Nil	**Progressive Courses**	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	**Learning**		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Identify the various formwork system for construction			
CLR-2 :	Analyze the basic concepts of functional requirement of building			
CLR-3 :	Explore the advanced concepts of green building construction			
CLR-4 :	Understand various concepts and applications of BIM			
CLR-5 :	Identify the various lean tools for sustainable construction			
CLR-6 :	Explore the knowledge in the field of energy efficiency of buildings			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
		Program Learning Outcomes (PLO)			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO-1 :	Accrue the knowledge of various sustainable formwork system and formwork management	2	85	80	H	M	M	L	M	-	M	-	M	L	M	H	M	-	-
CLO-2 :	Apply the knowledge of planning, orientation, and selection of modern material for green building concepts	3	80	75	H	L	L	L	M	-	H	-	H	H	H	M	M	-	--
CLO-3 :	Accrue the knowledge of rating system for certification of green building	2	85	75	H	H	-	M	M	-	H	-	L	H	H	M	M	-	-
CLO-4 :	Utilize various concepts and applications of BIM	2	80	75	H	H	-	M	M	-	H	-	L	L	H	M	M	-	-
CLO-5 :	Apply the lean tools for sustainable construction	2	85	75	H	H	-	H	M	M	H	-	L	-	H	M	M	-	-
CLO-6 :	Accrue comprehensive knowledge in the field of energy efficiency of buildings	3	90	85	H	H	-	M	H	-	H	-	L	-	H	H	M	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Basics of Formwork and Staging	Principles of Planning	Green Building - Introduction	BIM –Introduction	Energy and Environment
	SLO-2	Form work materials	Planning Regulations and Byelaws	Benefits of Green Buildings,	Software's used for Building Information modeling	Energy efficiency and conservation
S-2	SLO-1	Types of form work	Orientation of Building	Green Building Materials and Equipment in India	Categories of BIM	Introduction to clean energy technologies
	SLO-2	Quantity calculation	Functional Requirements of a Building	Key Requisites for Constructing a Green Building	BIM in Project Development stage	Importance in sustainable development
S-3	SLO-1	Advancement of form work	Life-cycle assessment of construction building	Important Sustainable features for Green Building	BIM in Design stage	Energy consumption and sustainability
	SLO-2	System Formwork		Indian Green Building Council	BIM in Implementation stage	Future energy use - influenced by economic and environmental factors
S-4	SLO-1	Mivan form work system - basics	Traditional construction method	Green Building Moment in India	BIM in maintenance of buildings	Identification of energy related enterprises that represent the breath of the industry
	SLO-2					
S-5	SLO-1	Procedures of Mivan form work system	Advanced construction methods	Benefits Experienced in Green Buildings	Lean concepts	Energy Modeling
	SLO-2	Formwork for Structural system	Construction projects	Launch of Green Building Rating Systems	Application of lean tools in construction	Use as a tool for measuring sustainability

S-6	*SLO-1*	*Foundation and wall formwork*	*Engineering Materials*	*Residential Sector*	*General Principles of passive Solar Heating*	*Energy Audit of Facilities*
	SLO-2	*Column, Beam, and slab formwork*	*Sustainable building materials*	*Opportunities of Green Building*	*General Principles of Passive Cooling*	*Optimization of energy consumption*
S-7	*SLO-1*	*Formwork for special structures*	*Environmental impact of materials*	*Green Building Features*	*Thermal Design of buildings Influence of Design Parameters – Mechanical controls*	*Energy efficiency ,an overview of design concepts, and architectural interventions*
	SLO-2	*Formwork for precast structures*	*Advantage and disadvantage*	*LEED India Rating System*	*Direct gain – Trombe Walls, Water Walls Radiant Barriers, Glazing material*	*Energy efficient buildings for various zones - cold, and cloudy*
S-8	*SLO-1*	*Formwork failure*	*Material selection to optimize performance Process for selection*	*Parameters for Rating system*	*Ventilation –Requirements – Minimum standards for ventilation*	*Cold and sunny; composite – hot and dry; moderate.*
	SLO-2	*Case studies*			*Ventilation Design ,Energy Conservation*	
S-9	*SLO-1*	*Pre award formwork management system*	*Green construction materials*	*HVAC System for Green Building*	*Ventilating systems – Design for Natural Ventilation*	*Warm and humidcase studies of residences*
	SLO-2	*Post award formwork management system*	*Production process*	*Design philosophy*	*Ventilation –Requirements – Minimum standards for ventilation*	*Applications of Operational Research in construction management*

Learning Resources	1. *Robert L. Peurifoy and Garold D. Oberlender, "Formwork for Concrete Structures", McGraw- Hill, 2006.* 2. *Hurd. M.K., "Formwork for Concrete", Special Publication No.4 Fifth Edition American Concrete Institute, Detroit, 2003.* 3. *A Text book of Building Construction, S.P. Arora and S.P. Bindra, DhanpatRai& Sons.* 4. *Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.*	5. *Green Building Hand Book by Tomwoolley and Samkimings, 2009.* 6. *Moore, F., "Environmental Control System", McGraw Hill Inc. 2002* 7. *Brown, G.Z. and DeKay, M., "Sun, Wind and Light – Architectural Design Strategies", John Wiley and Sons Inc, 2001* 8. *"Energy Conservation Building Code, Bureau of Energy Efficiency", New Delhi, 2007.* 9. *https://nptel.ac.in/courses/105102088/* 10 *.https://nptel.ac.in/noc/individual_course.php?id=noc19-ce40*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*30%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		-100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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ACADEMIC CURRICULA

Project Work, Seminar,

Internship in Industry / Higher Technical Institutions

Courses

Regulations 2018

Volume – 4 (8)

SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Kancheepuram, Tamil Nadu, India

Course Code							Course Name	Course Category	P		L	T	P	C
	18ASP101L	18ASP104L	18AUP101L	18AUP104L	18BTP101L	18BTP104L	MASSIVE OPEN ONLINE COURSE - I / MASSIVE OPEN ONLINE COURSE - II			*Project Work, Seminar, Internship in Industry / Higher Technical Institutions*				
	18CHP101L	18CHP104L	18CEP101L	18CEP104L	18CSP101L	18CSP104L								
	18EEP101L	18EEP104L	18ECP101L	18ECP104L	18MEP101L	18MEP104L					0	0	2	1
	18MHP101L	18MHP104L	18NTP101L	18NTP104L										

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Improve Student Academic Characteristics and learning goals through forums, discussion groups, and blogs*
CLR-2 :	*Improve Student Personal Characteristics through self-learning habits*
CLR-3 :	*Characterize self-learning environment that includes pedagogy, tools, tasks, duration, feedback and assessments*
CLR-4 :	*Improve lifelong learning habits and Learning process*
CLR-5 :	*Characterize learning engagement methods and activities*
CLR-6 :	*Inculcate self-learning behavior and lifelong learning tendency*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*Inculcate student characteristics: prior-knowledge, prior-experience, expertise, academic achievement and matriculation*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	-	*H*	*H*	*H*	-	*H*	-	-	-
CLO-2 :	*Inculcate self-motivation, self-confidence, intrinsic motivation, participation, social economic statute, and task-orientation*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	-	*H*	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*Enhance self-learning through peer learning, learning groups, positive collaboration*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	-	*H*	*H*	*H*	-	*H*	-	-	-
CLO-4 :	*Explore different learning styles and activities, identify self-learning pace, difficulties and remedial measures*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	-	*H*	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*Identify ways of students' engagement, achievement, and attrition*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	-	*H*	*H*	*H*	-	*H*	-	-	-
CLO-6 :	*Identify ethical practices in self-learning and practice both individual and group learning dynamics*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	-	*H*	*H*	*H*	-	*H*	-	-	-

MOOC Course Selection: List of MOOC Courses that are Approved to be learned by the student in the respective semester will be displayed by the Department MOOC Committee. Student can pick any course from that list.

Learning Assessment	
MOOC Certification Obtained (80% weightage)	Final Presentation (20% weightage)

Note: Final Presentation by the student would be evaluated by the Department MOOC Committee.

Course Code	18ASP102L 18CHP102L 18EEP102L 18MHP102L	18ASP105L 18CHP105L 18EEP105L 18MHP105L	18AUP102L 18CEP102L 18ECP102L 18NTP102L	18AUP105L 18CEP105L 18ECP105L 18NTP105L	18BTP102L 18CSP102L 18MEP102L	18BTP105L 18CSP105L 18MEP105L	Course Name	INDUSTRIAL TRAINING – I / INDUSTRIAL TRAINING – II	Course Category	P	*Project Work, Seminar, Internship in Industry / Higher Technical Institutions*	L	T	P	C
												0	0	2	1

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Train oneself in finding the aspects in real-time work environment and prepare them to join the workforce in the future*
CLR-2 :	*Gain Exposure to the actual working conditions including rules, regulations and safety practices*
CLR-3 :	*Enhance and supplement the knowledge and skills of the students*
CLR-4 :	*Develop the students in terms of ability, competence and interpersonal relationship*
CLR-5 :	*Enhance students' knowledge in one particular technology*
CLR-6 :	*Provide learning platform that can enhance their employ ability skills*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	PLO 1 Engineering Knowledge	2 Problem Analysis	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	13 PSO - 1	14 PSO - 2	15 PSO - 3
CLO-1 :	*Apply knowledge of Mathematics, Science, and Engineering Fundamentals in the real world of work*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-2 :	*Demonstrate competency in relevant engineering fields through problem identification, formulation and solution*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-3 :	*Effectively implement skills in professional communication, technical writing and using multimedia tools*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-4 :	*Develop ability to work as an individual and in a group as an effective team member*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-5 :	*Master the professional and ethical responsibilities of an engineer*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-6 :	*Generate a report based on the experiences and projects carried out in a real-world work environment*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-

Industrial Training Selection: List of Industries for Industrial Training for students would be finalized by the Department Internship/Industrial Training Committee.

Learning Assessment	
Industrial Training Certification Obtained (80% weightage)	Final Presentation (20% weightage)

Note: Final Presentation Evaluation would be done by the Internship/Industrial Training Committee formed by the Department.

Course Code	18ASP103L	18ASP106L	18AUP103L	18AUP106L	18BTP103L	18BTP106L	Course Name	SEMINAR – I / SEMINAR – II	Course Category	P	*Project Work, Seminar, Internship in Industry / Higher Technical Institutions*	L	T	P	C
	18CHP103L	18CHP106L	18CEP103L	18CEP106L	18CSP103L	18CSP106L						0	0	2	1
	18EEP103L	18EEP106L	18ECP103L	18ECP106L	18MEP103L	18MEP106L									
	18MHP103L	18MHP106L	18NTP103L	18NTP106L											

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Utilize fundamental principles, generalizations, or theories and ability to present the same*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	*Increase self-motivation, personal responsibility, understand one's role of being an informed participant*			
CLR-3 :	*Create an environment that helps the student establish healthy relationships and support networks*			
CLR-4 :	*State and explain some specific skills, competencies, and points of view*			
CLR-5 :	*Identify, apply appropriate note-taking, test-taking, and time-management strategies to the academic studies*			
CLR-6 :	*Develop critical thinking, information literacy, Interdisciplinary Inquiry, Engaging with Big Questions and Major Works*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Gaining factual knowledge (terminology, classifications, methods, trends)*	*3*	*95*	*85*
CLO-2 :	*Rlate to their interests, abilities, career choices, and personal development*	*3*	*95*	*85*
CLO-3 :	*Develop a plan that demonstrates their responsibility for their own education*	*3*	*95*	*85*
CLO-4 :	*Explain the role of self-efficacy, personal goals, and motivation in improving academic life*	*3*	*95*	*85*
CLO-5 :	*Describe the behaviors and characteristics of an effective learner*	*3*	*95*	*85*
CLO-6 :	*Improve the Presentation Skills, Discussion Skills, Listening Skills, Argumentative Skills, Critical Thinking, Questioning*	*3*	*95*	*85*

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-2 :	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-3 :	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-4 :	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-5 :	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-
CLO-6 :	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	-	*H*	-	-	-

Seminar Selection: List of Seminar Topics that are Approved to be learned by the student in the respective semester will be displayed by the Department Seminar Selection/Evaluation Committee. Student can pick any topic from that list.

Learning Assessment	
Seminar Preparation Materials & Report (80% weightage)	Final Presentation (20% weightage)

Note: Final Presentation Evaluation would be done by the Seminar Evaluation Committee formed by the Department.

Course Code	18ASP107L 18EEP107L	18AUP107L 18ECP107L	18BTP107L 18MEP107L	18CHP107L 18MHP107L	18CEP107L 18NTP107L	18CSP107L	Course Name	MINOR PROJECT	Course Category	P	*Project Work, Seminar, Internship in Industry / Higher Technical Institutions*	L	T	P	C
												0	0	6	3

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Learn responsible and professional way of working*
CLR-2 :	*Practice development-oriented approach to work*
CLR-3 :	*Enhance students' knowledge in one particular technology*
CLR-4 :	*Create awareness of the social, cultural, global and environmental responsibility as an engineer*
CLR-5 :	*Grow more empathetic, become systems thinkers, become explorers, problem-solvers.*
CLR-6 :	*Learn project management.*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*Develop capability to acquire and apply fundamental principles of engineering*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-2 :	*Become updated with all the latest changes in technological world*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-3 :	*Make deep connections between ideas*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-4 :	*Learn to take creative risks*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-5 :	*Be ready for the creative economy also engage in iterative thinking and divergent thinking*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-6 :	*Identify, formulate and model problems and find engineering solution based on a systems approach*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-

Project Work Selection: Project Work Titles for students would be finalized by the Department Project Work Evaluation Committee.

Learning Assessment	
MOOC Certification Obtained (80% weightage)	Final Presentation (20% weightage)

Note: Final Presentation Evaluation would be done by the Department Project Work Evaluation Committee formed by the Department.

Course Code	18ASP108L 18AUP108L 18BTP108L 18CHP108L 18CEP108L 18CSP108L 18EEP108L 18ECP108L 18MEP108L 18MHP108L 18NTP108L	Course Name	INTERNSHIP	Course Category	P	*Project Work, Seminar, Internship in Industry / Higher Technical Institutions*	L	T	P	C
							0	0	6	3

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Understanding of industry/organization customs and practices*			
CLR-2 :	*Demonstrate professional skills that pertain directly to the internship experience*			
CLR-3 :	*Demonstrate effective verbal and written communication skills, Allocate time effectively*			
CLR-4 :	*1. Demonstrate effective listening skills*			
CLR-5 :	*2. Participate well as a team member and build professional network*			
CLR-6 :	*Build a record of work experience, Develop work habits and attitudes necessary for job success*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*3. Adapt effectively to changing conditions*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-2 :	*4. Demonstrate appropriate workplace attitudes*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-3 :	*Demonstrate individual responsibility*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-4 :	*Demonstrate effective management of personal behavior, ethics and attitudes*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-5 :	*Practice ethical standards appropriate to the internship site*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-6 :	*Explore career alternatives prior to graduation, Integrate theory and practice*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-

Internship Training Selection: List of Industries / Research Centre's for Internship Training for students would be finalized by the Department Internship/Industrial Training Committee.

Learning Assessment	
Internship Certification Obtained (80% weightage)	Final Presentation (20% weightage)

Note : Final Presentation Evaluation would be done by the Internship/Industrial Training Committee formed by the Department.

Course Code	18ASP109L 18AUP109L 18BTP109L 18CHP109L 18CEP109L 18CSP109L 18EEP109L 18ECP109L 18MEP109L 18MHP109L 18NTP109L	Course Name	PROJECT	Course Category	P	*Project Work, Seminar, Internship in Industry / Higher Technical Institutions*	L	T	P	C
							0	0	20	10

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Learn responsible and professional way of working*
CLR-2 :	*Practice development-oriented approach to work*
CLR-3 :	*Enhance students' knowledge in one particular technology*
CLR-4 :	*Create awareness of the social, cultural, global and environmental responsibility as an engineer*
CLR-5 :	*Grow more empathetic, become systems thinkers, become explorers, problem-solvers.*
CLR-6 :	*Learn project management.*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*Develop capability to acquire and apply fundamental principles of engineering*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-2 :	*Become updated with all the latest changes in technological world*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-3 :	*Make deep connections between ideas*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-4 :	*Learn to take creative risks*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-5 :	*Be ready for the creative economy also engage in iterative thinking and divergent thinking*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-6 :	*Identify, formulate and model problems and find engineering solution based on a systems approach*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-

Project Work Selection: Project Work Titles for students would be finalized by the Department Project Work Evaluation Committee.

Learning Assessment	
Project Report (80% weightage)	Final Presentation (20% weightage)

Note: Final Presentation Evaluation would be done by the Department Project Work Evaluation Committee formed by the Department.

Course Code	18ASP110L 18AUP110L 18BTP110L 18CHP110L 18CEP110L 18CSP110L 18EEP110L 18ECP110L 18MEP110L 18MHP110L 18NTP110L	Course Name	SEMESTER INTERNSHIP	Course Category	P	*Project Work, Seminar, Internship in Industry / Higher Technical Institutions*	L	T	P	C
							0	0	20	10

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Become job ready along with real corporate exposure*			
CLR-2 :	*Increase self-confidence and helps in finding their own proficiency*			
CLR-3 :	*Cultivate leadership ability and responsibility to perform or execute the given task*			
CLR-4 :	*Inculcate learners hands on practice within a real job situation*			
CLR-5 :	*Create awareness of the social, cultural, global and environmental responsibility as an engineer*			
CLR-6 :	*Become able to identify, formulate and model problems and find engineering solution based on a systems approach*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*Enhance capability to acquire and apply fundamental principles of engineering*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-2 :	*Become master in one's specialized technology*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-3 :	*Become updated with all the latest changes in technological world*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-4 :	*Demonstrate hands on practice within a real job situation*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-5 :	*Inculcate self-improvement through continuous professional development and life-long learning*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-
CLO-6 :	*Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills*	*3*	*95*	*85*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*H*	*H*	*H*	*H*	*H*	-	-	-

Internship Training Selection: List of Industries / Research Centre's for Internship Training for students would be finalized by the Department Internship/Industrial Training Committee.

Learning Assessment	
Internship Certification Obtained (80% weightage)	Final Presentation (20% weightage)

Note : Final Presentation Evaluation would be done by the Internship/Industrial Training Committee formed by the Department.

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Kancheepuram District-603203, Tamil Nadu, India

10. B.Tech. in Civil Engineering with Computer Applications

10. (a) Mission of the Department

Mission Stmt - 1	*To move up through international alliances and collaborative initiatives in civil engineering to achieve global excellence*
Mission Stmt - 2	*To accomplish a process to advance` knowledge in a rigorous research environment related to civil engineering and allied disciplines*
Mission Stmt - 3	*To attract and build people in a rewarding and inspiring environment by fostering freedom, empowerment, creativity and innovation.*

10. (b) Program Educational Objectives (PEO)

PEO - 1	*Graduates will pursue higher studies in civil engineering software applications, management and other related fields*
PEO - 2	*Graduates will perform as professional engineers in the fields of civil engineering*
PEO - 3	*Graduates will perform in diverse fields and gradually move into teamwork and leadership positions.*
PEO - 4	*Graduates will contribute to the development of the profession, nation and society*

10. (c) Mission of the Department to Program Educational Objectives (PEO) Mapping

	Mission Stmt. - 1	Mission Stmt. - 2	Mission Stmt. - 3
PEO - 1	*H*	*H*	*M*
PEO - 2	*H*	*M*	*H*
PEO - 3	*H*	*M*	*H*
PEO - 4	*H*	*M*	*H*

H – High Correlation, M – Medium Correlation, L – Low Correlation

10. (d) Mapping Program Educational Objectives (PEO) to Program Learning Outcomes (PLO)

	Program Learning Outcomes (PLO)														
	Graduate Attributes (GA)												Program Specific Outcomes (PSO)		
	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
PEO - 1	*H*	*H*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*H*	*H*
PEO - 2	*H*	*H*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*H*	*H*
PEO - 3	*L*	*L*	*L*	*L*	*M*	*M*	*L*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*M*
PEO - 4	*L*	*L*	*L*	*L*	*L*	*H*	*H*	*H*	*M*	*M*	*M*	*H*	*M*	*M*	*M*

H – High Correlation, M – Medium Correlation, L – Low Correlation

PSO – Program Specific Outcomes (PSO)

PSO - 1	*Graduates apply the knowledge of mathematical and physical sciences to solve problems in structural engineering, construction engineering management, geotechnical engineering, water resources engineering, environmental engineering and transportation engineering*
PSO - 2	*Graduates are capable of handling and applying modern engineering tools, software, Remote Sensing and GIS for solving civil engineering related problems*
PSO - 3	*Graduates are capable of working in teams in laboratory and industrial environment and carrying out major design projects*

10. (e) Program Structure: B.Tech. in Civil Engineering with Computer Applications

Humanities & Social Sciences including Management Courses (H)

Course Code	Course Title	Hours/ Week L	T	P	C
18LEH101J	English	2	0	2	3
18LEH102J	Chinese	2	0	2	3
18LEH103J	French				
18LEH104J	German				
18LEH105J	Japanese				
18LEH106J	Korean				
18PDH101T	General Aptitude	0	0	2	1
18PDH102T	Management Principles for Engineers	2	0	0	2
18PDH103T	Social Engineering	2	0	0	2
18PDH201T	Employability Skills & Practices	0	0	2	1
	Total Learning Credits				**12**

Engineering Science Courses (S)

Course Code	Course Title	Hours/ Week L	T	P	C
18MES101L	Engineering Graphics and Design	1	0	4	3
18MES102J	Basic Civil and Mechanical Engineering	3	1	2	5
18EES102L	Electrical and Electronics Eng. Workshop	1	0	4	3
18CSS101J	Programming for Problem Solving	3	0	4	5
	Total Learning Credits				**16**

Mandatory Courses (M)

Code	Course Title	L	T	P	C
18PDM101L	Professional Skills and Practices	0	0	2	0
18PDM201L	Competencies in Social Skills	0	0	2	0
18PDM203L	Entrepreneurial Skill Development				
18PDM202L	Critical and Creative Thinking Skills	0	0	2	0
18PDM204L	Business Basics for Entrepreneurs				
18PDM301L	Analytical and Logical Thinking Skills	0	0	2	0
18PDM302L	Entrepreneurship Management				
18LEM101T	Constitution of India	1	0	0	0
18LEM102J	Value Education	1	0	1	0
18GNM101L	Physical and Mental Health using Yoga	0	0	2	0
18GNM102L	NSS	0	0	2	0
18GNM103L	NCC				
18GNM104L	NSO				
18LEM109T	Indian Traditional Knowledge	1	0	0	0
18LEM110L	Indian Art Form	0	0	2	0
18CYM101T	Environmental Science	1	0	0	0
18CEM401J	Professional Enhancement Course 1	1	0	2	0
18CEM402T	Professional Enhancement Course 2	1	0	0	0

Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P)

Course Code	Course Title	Hours/ Week L	T	P	C
18CEP101L	Massive Open Online Course - I	0	0	2	1
18CEP102L	Industrial Training-I				
18CEP103L	Seminar - I				
18CEP104L	Massive Open Online Course - II	0	0	2	1
18CEP105L	Industrial Training-II				
18CEP106L	Seminar - II				
18CEP107L	Minor Project	0	0	6	3
18CEP108L	Internship (4-6 weeks)				
18CEP109L	Project	0	0	20	10
18CEP110L	Semester Internship				
	Total Learning Credits				**15**

Professional Elective Courses (E)
Any 6 Courses

Course Code	Course Title	Hours/ Week L	T	P	C
	Structural Engineering				
18CEE305J	Concrete Technology	2	0	2	3
18CEE306T	Prestressed Concrete Structures	3	0	0	3
18CEE307T	Design of Earthquake Resistant Structures	3	0	0	3
18CEE308T	Design of Steel-Concrete Composite Structures	3	0	0	3
18CEE309T	Geographic Information System	3	0	0	3

Basic Science Courses (B)

Course Code	Course Title	Hours/ Week L	T	P	C
18PYB102J	Physics: Mechanics and Mechanics of Solids	3	1	2	5
18CYB101J	Chemistry	3	1	2	5
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18MAB201T	Transforms and Boundary Value Problems	3	1	0	4
18MAB202T	Numerical Methods for Engineers	3	1	0	4
18MAB301T	Probability and Statistics	3	1	0	4
18BTB101T	Biology	2	0	0	2
	Total Learning Credits				**32**

Professional Core Courses (C)

Course Code	Course Title	Hours/ Week L	T	P	C
18CEC201T	Engineering Geology	3	1	0	4
18CEC202T	Fluid Mechanics	2	1	0	3
18CEC202L	Fluid Mechanics Laboratory	0	0	2	1
18CEC203T	Mechanics of Structures	2	1	0	3
18CEC203L	Strength of Materials Laboratory	0	0	2	1
18CEC204T	Engineering Surveying	2	1	0	3
18CEC204L	Engineering Surveying Laboratory	0	0	2	1
18CEC205T	Structural Analysis	2	1	0	3
18CEC205L	Computer Aided Structural Analysis Laboratory	0	0	2	1
18CEC206T	Hydraulic Engineering and Design	2	1	0	3
18CEC206L	Hydraulic Engineering Laboratory	0	0	2	1
18CEC207T	Design of RC and Steel Structures	4	0	0	4
18CEC208T	Environmental Engineering and Design	2	1	0	3
18CEC208L	Environmental Engineering Laboratory	0	0	2	1
18CEC301T	Hydrology and Water Resources Engineering	3	1	0	4
18CEC302T	Geotechnical Engineering	2	1	0	3
18CEC302L	Geotechnical Engineering Laboratory	0	0	2	1
18CEC303T	Highway Engineering and Design	2	1	0	3
18CEC303L	Highway Engineering Laboratory	0	0	2	1
18CEC304T	Construction Engineering and Management	2	1	0	3
18CEC304L	Construction Engineering and Management Laboratory	0	0	2	1
18CEC350T	Comprehension	0	1	0	1
	Total Learning Credits				**49**

Open Elective Courses (O)
Any 6 Courses

Course Code	Course Title	Hours/ Week L	T	P	C
18CEO305J	Computer Application in Structural Engineering	1	0	4	3
18CEO306J	Computer Application in Construction Engineering and Management	1	0	4	3
18CE0307J	RS and GIS Application in Civil Engineering	1	0	4	3
18CEO308J	Computer Application in Geotechnical and Transportation Eng.	1	0	4	3
18CEO403J	Computer Application in Water Resources and Environmental Engineering	1	0	4	3
18CEO404J	Fundamentals of Computing	2	0	2	3
	Total Learning Credits				**18**
	Courses offered to other Engineering branches				
18CEO305T	Environmental Impact Assessment	3	0	0	3
18CEO306T	Municipal Solid Waste Management	3	0	0	3
18CEO307T	Disaster Mitigation and Management	3	0	0	3
18CEO405T	Water Pollution and its Management	3	0	0	3
18CE0406T	Global Warming and Climate Change	3	0	0	3
18CE0407T	Applications of Remote Sensing and GIS	3	0	0	3
	Total Learning Credits				**18**

Professional Elective Courses (E)
Any 6 Courses

Course Code	Course Title	Hours/ Week L	T	P	C
	Geotechnical Engineering				
18CEE301T	Foundation Engineering and Design	3	0	0	3
18CEE302T	Geotechnical Design	3	0	0	3
18CEE303T	Ground Improvement Techniques	3	0	0	3
18CEE304T	Foundation on Expansive Soil	3	0	0	3
	Water Resources Engineering				
18CEE313T	Design of hydraulic structures and Irrigation Engineering	3	0	0	3
18CEE314T	Ground Water Engineering	3	0	0	3

	Environmental Engineering				
18CEE310T	*Solid and Hazardous Waste Management*	*3*	*0*	*0*	*3*
18CEE311T	*Air and Noise Pollution and Control*	*3*	*0*	*0*	*3*
18CEE312T	*Environmental Impact Assessment and Life Cycle Analysis*	*3*	*0*	*0*	*3*
18CEE315T	*Surface Hydrology*	*3*	*0*	*0*	*3*
	Transportation Engineering				
18CEE401T	*Pavement Analysis and Design*	*3*	*0*	*0*	*3*
18CEE402T	*Railways, Airport and Harbour Engineering*	*3*	*0*	*0*	*3*
18CEE403T	*Traffic Engineering and Management*	*3*	*0*	*0*	*3*
	Construction Engineering and Mgmt.				
18CEE404T	*Construction Equipment and Automation*	*3*	*0*	*0*	*3*
18CEE405T	*Contracts Management*	*3*	*0*	*0*	*3*
18CEE406T	*Repairs and Rehabilitation of Structures*	*3*	*0*	*0*	*3*
18CEE407T	*Sustainable Construction Methods*	*3*	*0*	*0*	*3*
	Total Learning Credits				**18**

10. (f) Program Articulation: B.Tech. in Civil Engineering with Computer Applications

Course Code	Course Name	Program Learning Outcomes (PLO)													
		Graduate Attributes											PSO		
		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
18CEC201T	*Engineering Geology*	*H*	*H*	*M*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*M*	*M*	*M*
18CEC202T	*Fluid Mechanics*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*M*	*M*	*M*
18CEC202L	*Fluid Mechanics Laboratory*	*H*	*H*	*M*	*M*	*M*	*L*	*M*	*M*	*L*	*M*	*L*	*H*	*M*	*M*	*L*
18CEC203T	*Mechanics of Structures*	*H*	*M*	*M*	*M*	*M*	*L*	*M*	*L*	*M*	*M*	*L*	*H*	*H*	*H*	*H*
18CEC203L	*Strength of Materials Laboratory*	*H*	*M*	*M*	*M*	*M*	*L*	*M*	*L*	*M*	*M*	*M*	*H*	*H*	*H*	*H*
18CEC204T	*Engineering Surveying*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*M*	*M*	*M*	*M*
18CEC204L	*Engineering Surveying Laboratory*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	*M*	*L*	*M*	*H*	*L*	*H*	*L*
18CEC205T	*Structural Analysis*	*H*	*H*	*M*	*H*	*M*	*L*	*M*	*M*	*L*	*L*	*M*	*H*	*M*	*L*	*M*
18CEC205L	*Computer Aided Structural Analysis Laboratory*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*M*	*L*	*L*	*L*
18CEC206T	*Hydraulic Engineering and Design*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	*H*	*L*	*M*	*H*	*H*	*H*	*L*
18CEC206L	*Hydraulic Engineering Laboratory*	*H*	*H*	*M*	*H*	*M*	*L*	*M*	*M*	*L*	*L*	*M*	*H*	*M*	*L*	*M*
18CEC207T	*Design of RC and Steel Structures*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*M*	*M*	*M*	*M*
18CEC208T	*Environmental Engineering and Design*	*H*	*H*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*L*	*L*	*L*
18CEC208L	*Environmental Engineering Laboratory*	*H*	*H*	*H*	*H*	*M*	*L*	*M*	*L*	*H*	*L*	*M*	*H*	*M*	*H*	*L*
18CEC301T	*Hydrology and Water Resources Engineering*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*L*
18CEC302T	*Geotechnical Engineering*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*L*	*M*	*L*	*L*	*H*	*H*	*M*	*M*
18CEC302L	*Geotechnical Engineering Laboratory*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*M*	*M*	*M*	*M*
18CEC303T	*Highway Engineering and Design*	*H*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*H*	*M*	*M*	*M*	*M*
18CEC303L	*Highway Engineering Laboratory*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*M*
18CEC304T	*Construction Engineering and Management*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*M*
18CEC304L	*Construction Engineering & Management Lab*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*M*
18CEC350T	*Comprehension*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*M*	*M*	*M*	*H*	*H*	*M*	*M*	*H*
18CEP101L	*Massive Open Online Course - I*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP102L	*Industrial Training-I*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP103L	*Seminar - I*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP104L	*Massive Open Online Course - II*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP105L	*Industrial Training-II*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP106L	*Seminar - II*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*M*	*H*	*H*	*H*
18CEP107L	*Minor Project*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*M*
18CEP108L	*Internship (4-6 weeks)*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*M*
18CEP109L	*Project*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*M*
18CEP110L	*Semester Internship*	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*M*
	Program Average	*H*	*H*	*M*	*H*	*M*	*L*	*M*	*L*	*M*	*M*	*M*	*H*	*M*	*M*	*M*

10. (g) Implementation Plan: B.Tech. in Civil Engineering with Computer Applications

Semester - I

Code	Course Title	Hours/ Week L	T	P	C
18LEH101J	English	2	0	2	3
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18PYB102J	Physics: Mechanics and Mechanics of Solids	3	1	2	5
18MES101L	Engineering Graphics and Design	1	0	4	3
18MES102J	Basic Civil and Mechanical Engineering	3	1	2	5
18PDM101L	Professional Skills and Practices	0	0	2	0
18LEM101T	Constitution of India	1	0	0	0
18GNM101L	Physical and Mental Health using Yoga	0	0	2	0
	Total Learning Credits				**20**

Semester - II

Code	Course Title	Hours/ Week L	T	P	C
18LEH10XJ	Chinese / French / German / Japanese/ Korean	2	0	2	3
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18CYB101J	Chemistry	3	1	2	5
18EES102L	Electrical and Electronics Eng. Workshop	1	0	4	3
18CSS101J	Programming for Problem Solving	3	0	4	5
18PDH101T	General Aptitude	0	0	2	1
18LEM102J	Value Education	1	0	1	0
18GNM102L	NSS	0	0	2	0
18GNM103L	NCC				
18GNM104L	NSO				
	Total Learning Credits				**21**

Semester - III

Code	Course Title	Hours/ Week L	T	P	C
18MAB201T	Transforms and Boundary Value Problems	3	1	0	4
18BTB101T	Biology	2	0	0	2
18CEC201T	Engineering Geology	3	1	0	4
18CEC202T	Fluid Mechanics	2	1	0	3
18CEC202L	Fluid Mechanics Laboratory	0	0	2	1
18CEC203T	Mechanics of Structures	2	1	0	3
18CEC203L	Strength of Materials Laboratory	0	0	2	1
18CEC204T	Engineering Surveying	2	1	0	3
18CEC204L	Engineering Surveying Laboratory	0	0	2	1
18PDH102T	Management Principles for Engineers	2	0	0	2
18PDM201L	Competencies in Social Skills	0	0	2	0
18PDM203L	Entrepreneurial Skill Development				
	Total Learning Credits				**24**

Semester - IV

Code	Course Title	Hours/ Week L	T	P	C
18MAB202T	Numerical Methods for Engineers	3	1	0	4
18CEC205T	Structural Analysis	2	1	0	3
18CEC205L	Computer Aided Structural Analysis Laboratory	0	0	2	1
18CEC206T	Hydraulic Engineering and Design	2	1	0	3
18CEC206L	Hydraulic Engineering Laboratory	0	0	2	1
18CEC207T	Design of RC and Steel Structures	4	0	0	4
18CEC208T	Environmental Engineering and Design	2	1	0	3
18CEC208L	Environmental Engineering Laboratory	0	0	2	1
18PDH103T	Social Engineering	2	0	0	2
18PDM202L	Critical and Creative Thinking Skills	0	0	2	0
18PDM204L	Business Basics for Entrepreneurs				
18CYM101T	Environmental Science	1	0	0	0
	Total Learning Credits				**22**

Semester - V

Code	Course Title	Hours/ Week L	T	P	C
18MAB301T	Probability and Statistics	3	1	0	4
18CEC301T	Hydrology and Water Resources Engineering	3	1	0	4
18CEC302T	Geotechnical Engineering	2	1	0	3
18CEC302L	Geotechnical Engineering Laboratory	0	0	2	1
	Professional Elective – 1	3	0	0	3
	Open Elective – 1	3	0	0	3
	Open Elective – 2	3	0	0	3
18CEP101L	Massive Open Online Course - I	0	0	2	1
18CEP102L	Industrial Training-I				
18CEP103L	Seminar - I				
18PDM301L	Analytical and Logical Thinking Skills	0	0	2	0
18PDM302L	Entrepreneurship Management				
18LEM109T	Indian Traditional Knowledge	1	0	0	0
	Total Learning Credits				**22**

Semester - VI

Code	Course Title	Hours/ Week L	T	P	C
18CEC303T	Highway Engineering and Design	2	1	0	3
18CEC303L	Highway Engineering Laboratory	0	0	2	1
18CEC304T	Construction Engineering and Management	2	1	0	3
18CEC304L	Construction Engineering and Management Laboratory	0	0	2	1
18CEC350T	Comprehension	0	1	0	1
	Professional Elective – 2	3	0	0	3
	Professional Elective – 3	3	0	0	3
	Open Elective – 3	3	0	0	3
	Open Elective – 4	3	0	0	3
18CEP104L	Massive Open Online Course - II	0	0	2	1
18CEP105L	Industrial Training-II				
18CEP106L	Seminar - II				
18PDH201T	Employability Skills and Practices	0	0	2	1
18LEM110L	Indian Art Form	0	0	2	0
	Total Learning Credits				**23**

Semester - VII

Code	Course Title	Hours/ Week L	T	P	C
	Professional Elective – 4	3	0	0	3
	Professional Elective – 5	3	0	0	3
	Professional Elective – 6	3	0	0	3
	Open Elective – 5	3	0	0	3
	Open Elective – 6	3	0	0	3
18CEP107L	Minor Project	0	0	6	3
18CEP108L	Internship (4-6 weeks)				
18CEM401J	Professional Enhancement Course 1	1	0	2	0
	Total Learning Credits				**18**

Semester - VIII

Code	Course Title	Hours/ Week L	T	P	C
18CEP109L	Project	0	0	20	10
18CEP110L	Semester Internship				
18CEM402T	Professional Enhancement Course 2	1	0	0	0
	Total Learning Credits				**10**