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 (%)	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 the various properties of fluid	2	85	80	H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Analyze hydrostatic pressure force	3	85	75	H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Apply hydrostatic laws in various pressure measuring devices	3	85	75	H	H	-	-	-	-	-	-	-	-	-	-	H	-	-
CLO-4 :	Identify the importance of fluid kinematics	2	85	80	H	H	-	M	-	-	-	-	-	-	-	-	H	-	-
CLO-5 :	Identify the applications of fluid dynamics	2	80	75	H	H	-	M	-	-	-	-	-	-	-	-	H	-	-
CLO-6 :	Analyze laminar and turbulent flow in pipes	3	85	75	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	Stability of floating and submerged bodies	Euler's equation and Bernoulli's equation	Reynolds experiment, frictional loss in pipe	Power transmission through pipe

		cavitation			*flow, Darcy Weisbach equation, minor energy losses*	
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:	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 :	Utilize pressure measurement for real-time applications	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 :	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:																		
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		
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. 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	beams with internal hinges, point of	Solving Problems	Column with eccentricity, core / kernel	Introduction to Clapeyron's theorem of

		stress	*contra flexure*		*section.*	*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
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Utilize the testing procedure to determine modulus of elasticity of steel, double shear test and hardness test			
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 (%)	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 modulus of elasticity of steel, double shear test and hardness test	3	90	85	H	M		-	M	-	-	-	H	-	-	-	H	-	H
CLO-2 :	Identify torsional, impact strength of steel, identify compressive strength of bricks and concrete	3	85	80	H	M	-	-	M	-	-	-	H	-	-	-	H	-	H
CLO-3 :	Apply the knowledge of non-destructive testing technique of rebound hammer and UPV tests	3	90	85	H	H	-	-	M	-	-	-	H	-	-	-	H	-	H
CLO-4 :	Compute stiffness and deflection of helical springs	3	85	80	H	M	-	-	M	-	-	-	H	-	-	-	H	-	H
CLO-5 :	Determine modulus of elasticity of concrete, split tensile strength and flexural strength of concrete	3	85	80	H	M	-	-	M	-	-	-	H	-	-	-	H	-	H
CLO-6 :	Find bond strength between steel bar and concrete (pull-out test)	3	85	80	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.,

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	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	Temporary Adjustments of Vernier Transit	Base of the object Inaccessible: Instrument	Tangential Systems: One Angle of	Methods of Simple curves Rankies

		compass		*station in the same vertical Plane as Elevated Object*	*Elevation and Other of Depression*	*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.,

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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
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Understand the behavior of indeterminate structures using slope deflection method			
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:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
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.,

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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	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:*
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*	4. *Chandramouli P.N., Applied Hydraulic Engineering, Yesdee, 2017*
	2. *Subramanya, K., Theory and application of fluid mechanics, Tata McGraw Hill, 2002*	5. *NPTEL Course-Hydraulics. https://nptel.ac.in/courses/105106114/#*
	3. *R.K., Fluid Mechanics and Hydraulic Machines, S.Chand, 2014*	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
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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
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:*	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 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	*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	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:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
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*	*Disinfection of water and Chlorination*	*Screening and Grit Chambers*	*Thickening, Conditioning and Dewatering*	*Reduction at source, recovery and recycle*

		methods			*of sludge*	
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
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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:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
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			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 :	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
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai, rajkumar@hecs.in	*1. Dr. S. Madhava Kumar, IIT Madras, mathav@iitm.ac.in*	*1. Mrs. Sija Arun, SRMIST*
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*

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	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:*	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
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:*																		
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.*	4. *Terzaghi K., Peck R.B., Soil Mechanics in Engineering Practice, John Wiley Ltd., 1967*
2. *Punmia B.C., Soil Mechanics and Foundations, Laxmi Publications Pvt. Ltd., 2000*	5. *NPTEL course – Geotechnical Engineering Laboratory : https://nptel.ac.in/courses/105101160/*
3. *Laboratory Manual for Soil Mechanics 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 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			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
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:*																		
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:*	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 :	*Evaluate the vehicular composition in the straight road and intersection*	*3*	*90*	*85*	*H*	*M*		-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
CLO-2 :	*Understand the travel time, delay and speed characteristics*	*3*	*85*	*80*	*H*	*M*	-	-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
CLO-3 :	*Apply the effective parking systems*	*3*	*90*	*85*	*H*	*M*	-	-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
CLO-4 :	*Grade the bitumen and select the aggregate for the preparation of bituminous mixture*	*3*	*85*	*80*	*H*	*M*	-	-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
CLO-5 :	*Design the aggregate gradation for bituminous mixture*	*3*	*85*	*80*	*H*	*M*	-	-	-	-	-	-	*H*	-	-	-	*H*	-	*H*
CLO-6 :	*Design the bituminous mixture mix proportion*	*3*	*85*	*80*	*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*
	2. *IS 73 : 2013, Paving Bitumen - Specification, 4th Revision, BIS, New Delhi*
	3. *IS 15462:2004, Polymer and Rubber Modified Bitumen - Specification, 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 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 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:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
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
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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		
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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:*			
CLO-1 :	*Practice and gain confidence to solve problems in Engineering Geology and Engineering Surveying*	*3*	*85*	*80*
CLO-2 :	*Practice and gain confidence to solve problems in Mechanics of Structures, Design of RCC & Steel and Structural Analysis*	*3*	*85*	*80*
CLO-3 :	*Practice and gain confidence to solve problems in Fluid Mechanics, Hydraulic Engineering Design and Hydrology*	*3*	*85*	*80*
CLO-4 :	*Practice and gain confidence to solve problems in Geotechnical Engineering*	*3*	*85*	*80*
CLO-5 :	*Practice and gain confidence to solve problems in Environmental Engineering*	*3*	*85*	*80*
CLO-6 :	*Practice and gain confidence to solve problems in Transportation Engineering*	*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,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*M*	*H*
H	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*M*	*H*
H	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*L*	*H*
H	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*L*	*H*
H	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*H*	*L*	*H*
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.,

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