FACULTY OF ENGINEERING AND TECHNOLOGY

CURRICULUM, PRE- REQUISITES/ CO-REQUISITES CHART, AND SYLLABUS FOR B.TECH

UNDER CHOICE BASED FLEXIBLE CREDIT SYSTEM

REGULATIONS 2015

(For students admitted from 2015-16 onwards)

Specialization: B.Tech Civil Engineering (Full Time)

Offering Department: Civil Engineering

Approved in the 32nd Academic Council Meeting held on 23rd July 2016

CONTENTS

COURSE CODE	TOPIC / COURSE TITLE	PAGE NUMBER
	Student Outcomes And C-D-I-O	**iv**
	Abbreviations	**v**
	Curriculum – Core Courses	**vi**
	Curriculum – Elective Courses	**viii**
	Listing of Courses	**ix**
	Pre/Co Requisites List	**xiii**
	Pre/Co Requisites Flow Chart	**xv**
	Year – I, Semester - I	
15CE101	Basic Civil Engineering	1
	Year – I, Semester - II	
15AR101	Principles Of Architecture	3
15CE102	Elements Of Building Material Science	5
	Year – II, Semester - I	
15CE201	Engineering Geology	7
15CE203	Mechanics Of Solids	9
15CE203L	Strength Of Materials Laboratory	12
15CE205	Fluid Mechanics	14
15CE207	Engineering Surveying	16
15CE207L	Surveying Laboratory	18
15CE209	Construction Technology	20
	Year – II Semester - II	
15CE202	Strength Of Materials	22
15CE204	Structural Design (Masonry& RCC)	25
15CE206L	Concrete And Highway Laboratory	27
15CE208	Applied Hydraulic Engineering	30
15CE210	Geomatics Surveying	32
15CE210L	Geomatics Surveying Laboratory And Survey Camp	34
	Year – III, Semester - I	
15CE301	Structural Analysis	36
15CE303	Structural Design -Steel	39
15CE305L	Hydraulic Engineering Laboratory	41
15CE309	Geotechnical Engineering-I	42
15CE309L	Geotechnical Engineering Laboratory	44
15CE311	Highway Engineering	45
15CE390L	Industrial Training I (Training To Be Undergone After Year II, Semester II)	48
	Year – III, Semester - II	
15CE302	Computer Aided Structural Analysis	49
15CE302L	Computer Aided Structural Analysis And Testing Laboratory	52
15CE304	Hydrology And Irrigation Engineering Design	54
15CE306M	Water Supply And Environmental Engineering And Design	57
15CE308	Geotechnical Engineering-II	59
15CE310	Principles Of Construction Management	61
15CE312L	Computer Applications In Construction Management	63
	Year – IV, Semester - I	
15CE401	Advanced RCC Design	65
15CE403	Advanced Steel Design	67
15CE405	Sanitary Engineering And Design	69
15CE407L	Environmental Engineering Laboratory	71
15CE409	Quantity Surveying And Valuation	72

STUDENT OUTCOMES

The curriculum and syllabus for B.Tech programs (2015) conform to outcome based teaching learning process. In general, ELEVEN STUDENT OUTCOMES (a-k) have been identified and the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these outcomes. Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear instructional objectives which are mapped to the student outcomes.

The student outcomes are:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

C-D-I-O INITIATIVE

The CDIO Initiative (CDIO is a trademarked initialism for **Conceive — Design — Implement — Operate**) is an innovative educational framework for producing the next generation of engineers. The framework provides students with an education stressing engineering fundamentals set in the context of Conceiving — Designing — Implementing — Operating real-world systems and products. Throughout the world, CDIO Initiative collaborators have adopted CDIO as the framework of their curricular planning and outcome-based assessment.

In the syllabus, every topic has been classified under one or more of C-D-I-O so that students and faculty alike are clear about the scope of learning to take place under each one of the topics.

SYMBOLS AND ABBREVIATIONS

AR	--	**Architecture Courses**
B	--	**Courses under Basic Science and Mathematics**
BT	--	**Biotechnology Courses**
C-D-I-O	--	**Conceive-Design-Implement-Operate**
CE	--	**Civil Engineering Courses**
CS	--	**Computer Science and Engineering Courses**
CY	--	**Chemistry Courses**
Dept.	--	**Department of Civil Engineering**
E with course code	--	**Elective Courses**
E	--	**Courses under Engineering Sciences**
EC	--	**Electronics and Communication Engineering Courses**
EE	--	**Electrical and Electronics Engineering Courses**
G	--	**Courses under Arts and Humanities**
IOs	--	**Instructional Objectives**
L	--	**Laboratory / Project / Industrial Training Courses**
LE	--	**Language Courses**
L-T-P-C	--	**L- Lecture Hours Per Week**
		T- Tutorial Hours Per Week
		P- Practical Hours Per Week
		C- Credits for a Course
M	--	**Courses with Multi Disciplinary Content**
MA	--	**Mathematics Courses**
ME	--	**Mechanical Engineering Courses**
NC	--	**NCC- National Cadet Corps**
NS	--	**NSS – National Service Scheme**
P	--	**Professional Core Courses**
PD	--	**Personality Development Courses**
PY	--	**Physics Courses**
SO/SOs	--	**Student Outcomes (a-k)**
SP	--	**NSO- National Sports Organization**
YG	--	**Yoga Course**

B.TECH CIVIL ENGINEERING CHOICE BASED FLEXIBLE CREDIT SYSTEM (CBFCS) Curriculum Under Regulations 2015 (For students admitted from 2015-16 onwards)

L Lecture Hrs / Week	T Tutorial Hours / Week	C Credits	P Practical Hours / Week	L Laboratory Course	E Elective Courses J	Theory jointly with Lab	M Course with Multidisciplinary content

Year 1 / **Year 2**

Category	Category-wise % of Credits	Course Code	1st Semester Course Title	L	T	P	C	Course Code	2nd Semester Course Title	L	T	P	C	Course Code	1st Semester Course Title	L	T	P	C	Course Code	2nd Semester Course Title	L	T	P	C
Arts & Humanities - G (15)	8.33%	15LE101	English	2	0	0	2	15LE102	Value Education	2	0	0	2	15LE201E	German Language I					15LE207E	German Language II				
		15PD101	Soft Skills I	1	1	0	1	15PD102	Soft Skills II	1	1	0	1	15LE202E	French Language I					15LE208E	French Language II				
								15NC101	NCC- National Cadet Corps					15LE203E	Japanese Language I	2	0	0	2	15LE209E	Japanese Language II	2	0	0	2
								15NS101	NSS- National Service Scheme					15LE204E	Korean Language I					15LE210E	Korean Language II				
								15SP101	NSO- National Sports Organization	0	0	1	1	15LE205E	Chinese Language I					15LE211E	Chinese Language II				
								15YG101	Yoga					15PD201	Quantitative Aptitude & Logical Reasoning –I	1	1	0	1	15PD202	Verbal Aptitude	1	1	0	1
			Total	3	1	0	3		Total	3	1	1	4		Total	3	1	0	3		Total	3	1	0	3
Basic Sciences - B (38)	21.11%	15MA101	Calculus And Solid Geometry	3	1	0	4	15MA102	Advanced Calculus And Complex Analysis	3	1	0	4	15MA202	Fourier Series, Partial Differential Equations And Their Applications	4	0	0	4	15MA206	Numerical Methods	4	0	0	4
		15PY101	Physics	3	0	0	3	15PY102L	Materials Science	2	0	2	3	15CE201	Engineering Geology	3	0	0	3						
		15PY101L	Physics Laboratory	0	0	2	1	15CY102	Principles Of Environmental Science	2	0	0	2												
		15CY101	Chemistry	3	0	0	3																		
		15CY101L	Chemistry Laboratory	0	0	2	1																		
		15BT101	Biology For Engineers	2	0	0	2																		
			Total	11	1	4	14		Total	7	1	2	9		Total	7	0	0	7		Total	4	0	0	4
Engineering Sciences - E (15)	8.33%	15CE101	Basic Civil Engineering	2	0	0	2	15ME101	Basic Mechanical Engineering	2	0	0	2												
		15EE101	Basic Electrical Engineering	2	0	0	2	15EC101	Basic Electronics Engineering	2	0	0	2												
		15ME105L	Engineering Graphics	1	0	4	3	15ME104L	Workshop Practice	0	0	3	2												
		15CS101L	Programming Laboratory	1	0	2	2																		
			Total	6	0	6	9		Total	4	0	3	6		Total	0	0	0	0		Total	0	0	0	0
Professional - Core - P (75)	41.67%							15AR101	Principles Of Architecture	2	0	0	2	15CE203	Mechanics Of Solids	2	2	0	3	15CE202	Strength Of Materials	2	2	0	3
								15CE102	Elements Of Building Material Science	2	0	0	2	15CE203L	Strength Of Materials Laboratory	0	0	4	2	15CE204	Structural Design (Masonry & RCC)	2	2	0	3
														15CE205	Fluid Mechanics	3	0	0	3	15CE206L	Concrete And Highway Laboratory	0	0	4	2
														15CE207	Engineering Surveying	3	0	0	3	15CE208	Applied Hydraulic Engineering	3	0	0	3
														15CE207L	Surveying Laboratory	0	0	4	2	15CE210	Geomatics Surveying	3	0	0	3
														15CE209	Construction Technology	1	2	0	2	15CE210L	Geomatics Surveying Laboratory And Survey Camp	0	0	4	2
			Total	0	0	0	0		Total	4	0	0	4		Total	9	4	8	15		Total	10	4	8	16
Prof. - Electives - P (15)	8.33%																								
			Total	0	0	0	0		Total	0	0	0	0		Total	0	0	0	0		Total	0	0	0	0
Project / Seminar / Internship (16)	8.33%																								
			Total	0	0	0	0		Total	0	0	0	0		Total	0	0	0	0		Total	0	0	0	0
Open Electives (6)	`																								
			Total	0	0	0	0		Total	0	0	0	0		Total	0	0	0	0		Total	0	0	0	0
Total	180			20	2	10	26			18	2	6	23			19	5	8	25			17	5	8	23
			Contact hours	32					Contact hours	26					Total contact hours	32					Total Contact hours	30			

FACULTY OF ENGINEERING AND TECHNOLOGY, SRM UNIVERSITY

DEPARTMENT OF CIVIL ENGINEERING

B.TECH CIVIL ENGINEERING CHOICE BASED FLEXIBLE CREDIT SYSTEM (CBFCS) Curriculum Under Regulations 2015 (For students admitted from 2015-16 onwards)

L	Lecture Hours / Week	T	Tutorial Hours / Week	C Credits P Practical Hrs / Week	L	Laboratory Course	E Elective Courses	J	Theory jointly with Lab	M Course with Multidisciplinary content

Year 3				Year 4			
1st Semester		2nd Semester		1st Semester		2nd Semester	

Course Code	Course Title	L	T	P	C	Course Code	Course Title	L	T	P	C	Course Code	Course Title	L	T	P	C	Course Code	Course Title	L	T	P	C
15PD301	Communication & Reasoning Skills	1	1	0	1	15PD302	Quantitative Aptitude & Logical Reasoning –II	1	1	0	1		Total	0	0	0	0		Total	0	0	0	0
	Total	1	1	0	1		Total	1	1	0	1												
15MA301	Probability and Statistics	4	0	0	4																			
	Total	4	0	0	4		Total	0	0	0	0		Total	0	0	0	0		Total	0	0	0	0
	Total	0	0	0	0		Total	0	0	0	0		Total	0	0	0	0		Total	0	0	0	0
15CE301	Structural Analysis	2	2	0	3	15CE302	Computer Aided Structural Analysis	2	2	0	3	15CE401	Advanced RCC Design	1	2	0	2						
15CE303	Structural Design -Steel	2	2	0	3	15CE302L	Computer Aided Structural Analysis And Testing Laboratory	0	0	2	1	15CE403	Advanced Steel Design	1	2	0	2						
15CE305L	Hydraulic Engineering Laboratory	0	0	4	2	15CE304	Hydrology And Irrigation Engineering Design	1	2	0	2	15CE405	Sanitary Engineering And Design	1	2	0	2						
15CE309	Geotechnical Engineering-1	2	2	0	3	15CE306M	Water Supply And Environmental Engineering And Design	1	2	0	2	15CE407L	Environmental Engineering. Laboratory	0	0	2	1						
15CE309L	Geotechnical Engineering Laboratory	0	0	4	2	15CE308	Geotechnical Engineering-II	2	2	0	3	15CE409	Quantity Surveying And Valuation	1	2	0	2						
15CE311	Highway Engineering	2	2	0	3	15CE310	Principles Of Construction Management	2	1	0	2												
						15CE312L	Computer Applications In Construction Management	0	0	4	2												
	Total	8	8	8	16		Total	8	9	6	15		Total	4	8	2	9		Total	0	0	0	0
							Dept Elective-I	3	0	0	3		**Dept Elective-II**	3	0	0	3		**Dept Elective-IV**	3	0	0	3
													Dept Elective-III	3	0	0	3		**Dept Elective-V**	3	0	0	3
	Total	0	0	0	0		Total	3	0	0	3		Total	6	0	0	6		Total	6	0	0	6
15CE390L	Industrial Training (To be done after Year II, Semester II)	0	0	1	1							15CE391L	Industrial Training II (Training To Be Undergone After Year III, Semester II)	0	0	1	1	15CE496L	Major Project	0	0	24	12
												15CE375L	Minor Project	0	0	4	2						
	Total	0	0	1	1		Total	0	0	0	0		Total	0	0	5	3		Total	0	0	24	12
	Open Elective I	3	0	0	3		Open Elective II	3	0	0	3												
	As per list / as taken by the student						As per list / as taken by the student																
	Total	3	0	0	3		Total	3	0	0	3		Total	0	0	0	0		Total	0	0	0	0
		16	9	9	25			15	10	6	22			10	8	7	18			6	0	24	18
	Total Contact hours	34					**Total contact hours**	31					**Total contact hours**	25					**Total contact hours**	30			

B.Tech CIVIL Engineering (Regulations 2015) - List of Electives (Columns 1 & 2)

COURSE CODE	Course Title	L	T	P	C
Department Elective I (To Be Offered In III Year, Second Semester)		**3**	**0**	**0**	**3**
Transportation Engineering					
15CE350E	Railway, Airport And Harbour Engineering	3	0	0	3
15CE351E	Traffic Engineering	3	0	0	3
15CE352E	Pavement Engineering	3	0	0	3
15CE353E	Pavement Construction Technology	3	0	0	3
15CE354E	Pavement Management System	3	0	0	3
15CE355E	Transportation Systems Planning	3	0	0	3
15CE356E	Intelligent Transportation Systems	3	0	0	3
15CE357E	Urban Planning And Sustainable Development	3	0	0	3
Department Elective II (To Be Offered In IV Year, First Semester)		**3**	**0**	**0**	**3**
Water Resources Engineering					
15CE421E	Advanced Hydrology	3	0	0	3
15CE422E	Advanced Irrigation Engineering Design	3	0	0	3
15CE423E	Groundwater Engineering	3	0	0	3
15CE424E	Coastal Engineering And Management	3	0	0	3
15CE426E	Hydropower Engineering	3	0	0	3
Department Elective III (To Be Offered In IV Year, First Semester)		**3**	**0**	**0**	**3**
Construction Engineering And Management					
15CE430E	Advanced Construction Techniques	3	0	0	3
15CE431E	Construction Resource Planning And Management	3	0	0	3
15CE432E	Advanced Construction Project Management	3	0	0	3

Regarding open electives, all core / elective courses can be listed / delisted every semester, under open electives, based on the avaiblability of resources and demand

COURSE CODE	Course Title	L	T	P	C
Department Elective IV (To Be Offered In IV Year, Second Semester)		**3**	**0**	**0**	**3**
Geotechnical Engineering					
15CE440E	Advanced Geotechnical Engineering	3	0	0	3
15CE441E	Ground Improvement Techniques	3	0	0	3
15CE442E	Structures On Expansive Soil	3	0	0	3
15CE443E	Introduction To Soil Dynamics And Machine Foundation	3	0	0	3
15CE444E	Environmental Geotechnology	3	0	0	3
Structural Engineering					
15CE450E	Computer Analysis Of Structures	3	0	0	3
15CE451E	Computer Aided Design Of Structures	3	0	0	3
15CE452E	Tall Buildings	3	0	0	3
15CE453E	Storage And Industrial Structures	3	0	0	3
15CE454E	Advanced Prestressed Concrete Structures	3	0	0	3
15CE455E	Advanced Structural Design	3	0	0	3
15CE456E	Analysis And Design Of Strucutral Sandwich Panels	3	0	0	3
15CE457E	Bridge Engineering	3	0	0	3
15CE458E	Forensic Civil Engineering	3	0	0	3
15CE459E	Design Of Machine Foundation	3	0	0	3
15CE460E	Repair And Rehabilitation Of Structures	3	0	0	3
15CE461E	Design Of Earthquake Resistant Structures	3	0	0	3
15CE462E	Concrete Technology	3	0	0	3
15CE463E	Special Concretes	3	0	0	3
15CE464E	Concrete Testing Techniques	3	0	0	3
15CE465E	Design Of Steel-Concrete Composite Structures	3	0	0	3

DEPARTMENT ELECTIVE V (To be offered in IV year, second semester) — 3 0 0 3

COURSE CODE	GIS AND REMOTE SENSING	L	T	P	C
15CE321E	Geographical Information System	3	0	0	3
15CE322E	Remote Sensing And Its Applications	3	0	0	3
15CE323E	Photogrammetry Surveying	3	0	0	3
15CE324E	Elements Of Cartography	3	0	0	3
15CE325E	GPS Surveying	3	0	0	3
Engineering Geology					
15CE329E	Rock Mechanics	3	0	0	3
Environmental Engineering					
15CE331E	Industrial Pollution Prevention And Cleaner Production	3	0	0	3
15CE332E	Ground Water Contamination And Quality Monitoring And Modeling	3	0	0	3
15CE333E	Air Quality Monitoring And Modeling	3	0	0	3
15CE334E	Advanced Waste Water Treatment Design	3	0	0	3
15CE335E	Design Of Environmental Engineering Structures	3	0	0	3
15CE336E	Noise Pollution Control	3	0	0	3
15CE337E	Marine Pollution Monitoring And Modeling	3	0	0	3
15CE338E	Mass Transfer In Air-Water-Soil Interaction	3	0	0	3
15CE339E	Instrumental Monitoring Of Environment And Modeling	3	0	0	3
15CE340E	RS And GIS For Environmental Engineering	3	0	0	3
15CE341E	Air Pollution Control And Management	3	0	0	3
15CE342E	Environmental Health Engineering	3	0	0	3
15CE343E	Environmental Impact Assessment	3	0	0	3
15CE344E	Industrial Waste Management	3	0	0	3
15CE345E	Municipal Solid Waste Management	3	0	0	3

SCHEME OF PROFESSIONAL ELECTIVES

Elective Group	SPECIALIZATION	Year	Semester	Credit
I	**Transportation Engineering**	III	II	3
II	**Water Resources Engineering**	IV	I	3
III	**Construction Engineering And Management**	IV	I	3
IV	**Geotechnical Engineering**	IV	II	3
	Structural Engineering			
V	**GIS And Remote Sensing**			
	Engineering Geology	IV	II	3
	Environmental Engineering			

LISTING OF COURSES

COURSE CODE	TOPIC / COURSE TITLE	L	T	P	C
	Year – I, Semester - I				
15LE101	English	2	0	0	2
15PD101	Soft Skills I	1	1	0	1
15MA101	Calculus And Solid Geometry	3	1	0	4
15PY101	Physics	3	0	0	3
15PY101L	Physics Laboratory	0	0	2	1
15CY101	Chemistry	3	0	0	3
15CY101L	Chemistry Laboratory	0	0	2	1
15BT101	Biology For Engineers	2	0	0	2
15CE101	Basic Civil Engineering	2	0	0	2
15EE101	Basic Electrical Engineering	2	0	0	2
15ME105L	Engineering Graphics	1	0	4	3
15CS101L	Programming Laboratory	1	0	2	2
	Year – I, Semester - II				
15LE102	Value Education	2	0	0	2
15PD102	Soft Skills II	1	1	0	1
15NC101	NCC- National Cadet Corps	0	0	1	1
15NS101	NSS- National Service Scheme	0	0	1	1
15SP101	NSO- National Sports Organization	0	0	1	1
15YG101	Yoga	0	0	1	1
15MA102	Advanced Calculus And Complex Analysis	3	1	0	4
15PY102L	Materials Science	2	0	2	3
15CY102	Principles Of Environmental Science	2	0	0	2
15ME101	Basic Mechanical Engineering	2	0	0	2
15EC101	Basic Electronics Engineering	2	0	0	2
15ME104L	Workshop Practice	0	0	3	2
15AR101	Principles Of Architecture	2	0	0	2
15CE102	Elements Of Building Material Science	2	0	0	2
	Year – II, Semester - I				
15LE201E	German Language I	2	0	0	2
15LE202E	French Language I	2	0	0	2
15LE203E	Japanese Language I	2	0	0	2
15LE204E	Korean Language I	2	0	0	2
15LE205E	Chinese Language I	2	0	0	2
15PD201	Quantitative Aptitude & Logical Reasoning –I	1	1	0	1
15MA202	Fourier Series, Partial Differential Equations And Their Applications	4	0	0	4
15CE201	Engineering Geology	3	0	0	3
15CE203	Mechanics Of Solids	2	2	0	3
15CE203L	Strength Of Materials Laboratory	0	0	4	2
15CE205	Fluid Mechanics	3	0	0	3
15CE207	Engineering Surveying	3	0	0	3
15CE207L	Surveying Laboratory	0	0	4	2
15CE209	Construction Technology	1	2	0	2
	Year – II Semester - II				
15LE207E	German Language II	2	0	0	2
15LE208E	French Language II	2	0	0	2
15LE209E	Japanese Language II	2	0	0	2
15LE210E	Korean Language II	2	0	0	2
15LE211E	Chinese Language II	2	0	0	2

COURSE CODE	TOPIC / COURSE TITLE	L	T	P	C
15PD202	Verbal Aptitude	1	1	0	1
15MA206	Numerical Methods	4	0	0	4
15CE202	Strength Of Materials	2	2	0	3
15CE204	Structural Design (Masonry& RCC)	2	2	0	3
15CE206L	Concrete And Highway Laboratory	0	0	4	2
15CE208	Applied Hydraulic Engineering	3	0	0	3
15CE210	Geomatics Surveying	3	0	0	3
15CE210L	Geomatics Surveying Laboratory And Survey Camp	0	0	4	2
	Year – III, Semester - I				
15PD301	Communication and Reasoning Skills	1	1	0	1
15MA301	Probability and Statistics	4	0	0	4
15CE301	Structural Analysis	2	2	0	3
15CE303	Structural Design -Steel	2	2	0	3
15CE305L	Hydraulic Engineering Laboratory	0	0	4	2
15CE309	Geotechnical Engineering-I	2	2	0	3
15CE309L	Geotechnical Engineering Laboratory	0	0	4	2
15CE311	Highway Engineering	2	2	0	3
15CE390L	Industrial Training I (Training To Be Undergone After Year II, Semester II)	0	0	1	1
	Open Elective I	3	0	0	3
	Year – III, Semester - II				
15PD302	Quantitative Aptitude & Logical Reasoning –II	1	1	0	1
15CE302	Computer Aided Structural Analysis	2	2	0	3
15CE302L	Computer Aided Structural Analysis And Testing Laboratory	0	0	2	1
15CE304	Hydrology And Irrigation Engineering Design	1	2	0	2
15CE306M	Water Supply And Environmental Engineering And Design	1	2	0	2
15CE308	Geotechnical Engineering-II	2	2	0	3
15CE310	Principles Of Construction Management	2	1	0	2
15CE312L	Computer Applications In Construction Management	0	0	4	2
	Dept Elective-I	3	0	0	3
	Open Elective II	3	0	0	3
	Year – IV, Semester - I				
15CE401	Advanced RCC Design	1	2	0	2
15CE403	Advanced Steel Design	1	2	0	2
15CE405	Sanitary Engineering And Design	1	2	0	2
15CE407L	Environmental Engineering Laboratory	0	0	2	1
15CE409	Quantity Surveying And Valuation	1	2	0	2
	Dept Elective-II	3	0	0	3
	Dept Elective-III	3	0	0	3
15CE391L	Industrial Training II (Training To Be Undergone After Year III, Semester II)	0	0	1	1
15CE375L	Minor Project	0	0	4	2
	Year – IV, Semester – II				
	Dept Elective-IV	3	0	0	3
	Dept Elective-V	3	0	0	3
15CE496L	Major Project	0	0	24	12
	Elective Courses				
	Department Elective I(To be offered In II Semester of III Year)				
	Transportation Engineering				
15CE350E	Railway, Airport And Harbour Engineering	3	0	0	3
15CE351E	Traffic Engineering	3	0	0	3

COURSE CODE	TOPIC / COURSE TITLE	L	T	P	C
15CE352E	Pavement Engineering	3	0	0	3
15CE353E	Pavement Construction Technology	3	0	0	3
15CE354E	Pavement Management System	3	0	0	3
15CE355E	Transportation Systems Planning	3	0	0	3
15CE356E	Intelligent Transportation Systems	3	0	0	3
15CE357E	Urban Planning And Sustainable Development	3	0	0	3
	Department Elective II (To be offered In I Semester of IV Year)				
	Water Resources Engineering				
15CE421E	Advanced Hydrology	3	0	0	3
15CE422E	Advanced Irrigation Engineering Design	3	0	0	3
15CE423E	Groundwater Engineering	3	0	0	3
15CE424E	Coastal Engineering And Management	3	0	0	3
15CE426E	Hydropower Engineering	3	0	0	3
	Department Elective III(To be offered In I Semester of IV Year)				
	Construction Engineering And Management				
15CE430E	Advanced Construction Techniques	3	0	0	3
15CE431E	Construction Resource Planning And Management	3	0	0	3
15CE432E	Advanced Construction Project Management	3	0	0	3
	Department Elective IV (To be offered In II Semester of IV Year)				
	Geotechnical Engineering				
15CE440E	Advanced Geotechnical Engineering	3	0	0	3
15CE441E	Ground Improvement Techniques	3	0	0	3
15CE442E	Structures On Expansive Soil	3	0	0	3
15CE443E	Introduction To Soil Dynamics And Machine Foundation	3	0	0	3
15CE444E	Environmental Geotechnology	3	0	0	3
	Structural Engineering				
15CE450E	Computer Analysis Of Structures	3	0	0	3
15CE451E	Computer Aided Design Of Structures	3	0	0	3
15CE452E	Tall Buildings	3	0	0	3
15CE453E	Storage And Industrial Structures	3	0	0	3
15CE454E	Advanced Prestressed Concrete Structures	3	0	0	3
15CE455E	Advanced Structural Design	3	0	0	3
15CE456E	Analysis And Design Of Structural Sandwich Panels	3	0	0	3
15CE457E	Bridge Engineering	3	0	0	3
15CE458E	Forensic Civil Engineering	3	0	0	3
15CE459E	Design Of Machine Foundation	3	0	0	3
15CE460E	Repair And Rehabilitation Of Structures	3	0	0	3
15CE461E	Design Of Earthquake Resistant Structures	3	0	0	3
15CE462E	Concrete Technology	3	0	0	3
15CE463E	Special Concretes	3	0	0	3
15CE464E	Concrete Testing Techniques	3	0	0	3
15CE465E	Design Of Steel-Concrete Composite Structures	3	0	0	3
	Department Elective V (To be offered In II Semester of IV Year)				
	GIS And Remote Sensing	3	0	0	3
15CE321E	Geographical Information System	3	0	0	3
15CE322E	Remote Sensing And Its Applications	3	0	0	3
15CE323E	Photogrammetry Surveying	3	0	0	3
15CE324E	Elements Of Cartography	3	0	0	3

COURSE CODE	TOPIC / COURSE TITLE	L	T	P	C
15CE325E	GPS Surveying	3	0	0	3
	Engineering Geology				
15CE329E	Rock Mechanics	3	0	0	3
	Environmental Engineering				
15CE331E	Industrial Pollution Prevention And Cleaner Production	3	0	0	3
15CE332E	Ground Water Contamination And Quality Monitoring And Modeling	3	0	0	3
15CE333E	Air Quality Monitoring And Modeling	3	0	0	3
15CE334E	Advanced Waste Water Treatment Design	3	0	0	3
15CE335E	Design Of Environmental Engineering Structures	3	0	0	3
15CE336E	Noise Pollution Control	3	0	0	3
15CE337E	Marine Pollution Monitoring And Modeling	3	0	0	3
15CE338E	Mass Transfer In Air-Water-Soil Interaction	3	0	0	3
15CE339E	Instrumental Monitoring Of Environment And Modeling	3	0	0	3
15CE340E	RS And GIS For Environmental Engineering	3	0	0	3
15CE341E	Air Pollution Control And Management	3	0	0	3
15CE342E	Environmental Health Engineering	3	0	0	3
15CE343E	Environmental Impact Assessment	3	0	0	3
15CE344E	Industrial Waste Management	3	0	0	3
15CE345E	Municipal Solid Waste Management	3	0	0	3

Note : Students who join I Semester of II Year under lateral entry scheme have to undergo additional bridge courses in Mathematics, Physics and Chemistry as prescribed by the respective departments.

	B. Tech Civil Engineering 2015-16 Curriculum		
	Prerequisites/Co requisites		
Course Code	**Course Title**	**Prerequisite courses**	**Co requisite courses**
	Core Courses		
15CE202	Strength of Materials	15CE203	Nil
15CE208	Applied Hydraulic Engineering	15CE205	Nil
15CE204	Structural Design (Masonry& RCC)	15CE203	Nil
15CE210	Geomatics Surveying	15CE207	Nil
15CE210L	Geomatics Surveying Laboratory And Survey Camp	15CE207L	Nil
15CE301	Structural Analysis	15CE203	Nil
15CE303	Structural Design -Steel	15CE203	Nil
15CE305L	Hydraulic Engineering Laboratory	Nil	15CE208
15CE309L	Geotechnical Engineering Laboratory	Nil	15CE309
15CE302	Computer Aided Structural Analysis	15CE301	Nil
15CE302L	Computer Aided Structural Analysis and Testing Laboratory	Nil	15CE302
15CE308	Geotechnical Engineering-II	15CE309	Nil
15CE312L	Computer Applications In Construction Management	Nil	15CE310
15CE401	Advanced RCC Design	15CE204	Nil
15CE403	Advanced Steel Design	15CE303	Nil
15CE407L	Environmental Engineering Laboratory	15CE306M	Nil
	Department Elective -I		
	Transportation Engineering		
15CE350E	Railway, Airport and Harbour Engineering	15CE311	Nil
15CE351E	Traffic Engineering	15CE311	Nil
15CE352E	Pavement Engineering	15CE311	Nil
15CE353E	Pavement Construction Technology	15CE311	Nil
15CE354E	Pavement Management System	15CE311	Nil
15CE355E	Transportation Systems Planning	15CE311	Nil
15CE356E	Intelligent Transportation Systems	15CE311	Nil
15CE357E	Urban Planning and Sustainable Development	15CE311	Nil

	Department Elective -I		
	Water Resources Engineering		
15CE421E	Advanced Hydrology	15CE304	Nil
15CE422E	Advanced Irrigation Engineering Design	15CE304	Nil
15CE423E	Groundwater Engineering	15CE304	Nil
15CE426E	Hydropower Engineering	15CE208	Nil
	Department Elective -IV		
	Geotechnical Engineering		
15CE440E	Advanced Geotechnical Engineering	15CE308	Nil
15CE441E	Ground Improvement Techniques	15CE308	Nil
15CE442E	Structures on Expansive Soil	15CE308	Nil
15CE443E	Introduction to Soil Dynamics and Machine Foundation	15CE308	Nil
15CE444E	Environmental Geotechnology	15CE309	Nil
	Structural Engineering		
15CE450E	Computer Analysis of Structures	15CE301	Nil
15CE451E	Computer Aided Design of Structures	15CE302	Nil
15CE453E	Storage And Industrial Structures	15CE204	Nil
15CE455E	Advanced Structural Design	15CE204	Nil
15CE456E	Analysis And Design of Sandwich Panels	15CE202	Nil
15CE457E	Bridge Engineering	15CE204	Nil
15CE458E	Forensic Civil Engineering	15CE203	Nil
15CE465E	Design of Steel-Concrete Composite Structures	15CE303	Nil

B.Tech CIVIL ENGINEERING

PREREQUISITE / CO REQUISITE FLOW CHART FOR CORE DEPARTMENTAL COURSES

Curriculum and Syllabus – 2005-16

Year I	15CE101	15AR101	15ME105L	15CE102

Year II

15CE203 | 15CE203L | 15CE205 | 15CE207 | 15CE207L | 15CE209

15CE202 | 15CE204 | 15CE206L | 15CE208 | 15CE210 | 15CE210L

Year III

15CE301 | 15CE303 | 15CE305L | 15CE309 | 15CE309L | 15CE311 | 15CE390L

15CE302 | 15CE302L | 15CE304 | 15CE306M | 15CE308 | 15CE310 | 15CE312L | 15CE391L | 15CE375L

Year IV

15CE401 | 15CE403 | 15CE405 | 15CE407L | 15CE409

Legend

Courses which have prerequisites

Courses which have co requisites

xv

CE-Engg&Tech-SRM-2015

B.Tech CIVIL ENGINEERING

PREREQUISITE / CO REQUISITE FLOW CHART FOR DEPARTMENTAL ELECTIVE COURSES

(Student shall take only one course from each of the five groups of electives thus earning a total of 15 credits for the departmental elective courses))

Curriculum and Syllabus – 2005-16

```
                            15CE311
   ┌────────┬────────┬────────┬───┬────────┬────────┬────────┬────────┐
15CE350E 15CE351E 15CE352E 15CE353E 15CE354E 15CE355E 15CE356E 15CE357E
```
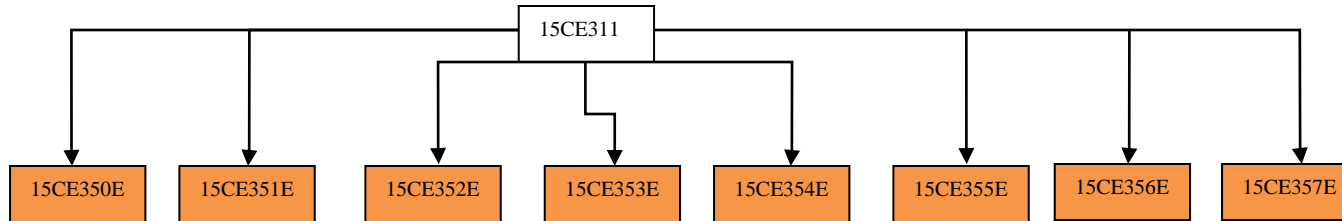
Elective I- Transportation Engineering – Year – III,

```
        15CE304                    15CE208
   ┌───────┬─────────┐                │
15CE421E 15CE422E 15CE423E       15CE426E       15CE424E
```

Elective II- Water Resources Engineering – Year – IV,

```
15CE430E    15CE431E    15CE432E
```
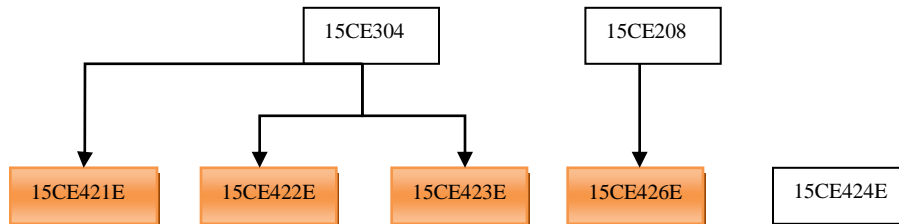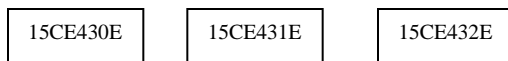
Elective III- Construction Engineering and Management – Year – IV,

```
                    ┌─────────────┐              ┌─────────────┐
                    │  15CE308    │              │  15CE309    │
                    └─────────────┘              └─────────────┘
        ┌──────┬──────────┬──────────┬──────────┐        │
        ▼      ▼          ▼          ▼           ▼
  ┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐
  │15CE440E  ││15CE441E  ││15CE422E  ││15CE443E  ││15CE444E  │
  └──────────┘└──────────┘└──────────┘└──────────┘└──────────┘
```
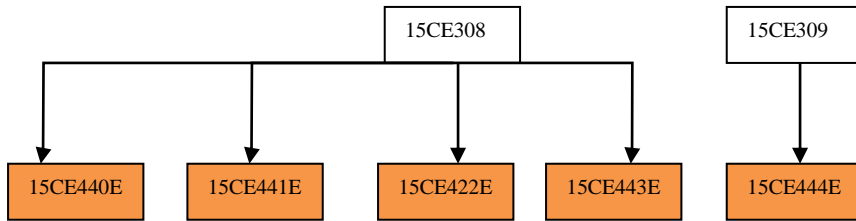
Elective IV- Geotechnical Engineering – Year – IV, Semester- II

```
┌──────────┐        ┌──────────┐           ┌──────────┐ ┌──────────┐ ┌──────────┐ ┌──────────┐
│15CE301   │        │15CE204   │           │15CE302   │ │15CE202   │ │15CE203   │ │15CE303   │
└──────────┘        └──────────┘           └──────────┘ └──────────┘ └──────────┘ └──────────┘
     │          ┌──────┼──────┐                  │           │            │            │
     ▼          ▼      ▼      ▼                  ▼           ▼            ▼            ▼
┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐
│15CE450E  ││15CE453E  ││15CE455E  ││15CE457E  ││15CE451E  ││15CE456E  ││15CE458E  ││15CE465E  │
└──────────┘└──────────┘└──────────┘└──────────┘└──────────┘└──────────┘└──────────┘└──────────┘

┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐
│15CE452E  ││15CE454E  ││15CE459E  ││15CE460E  ││15CE461E  ││15CE462E  ││15CE463E  ││15CE464E  │
└──────────┘└──────────┘└──────────┘└──────────┘└──────────┘└──────────┘└──────────┘└──────────┘
```
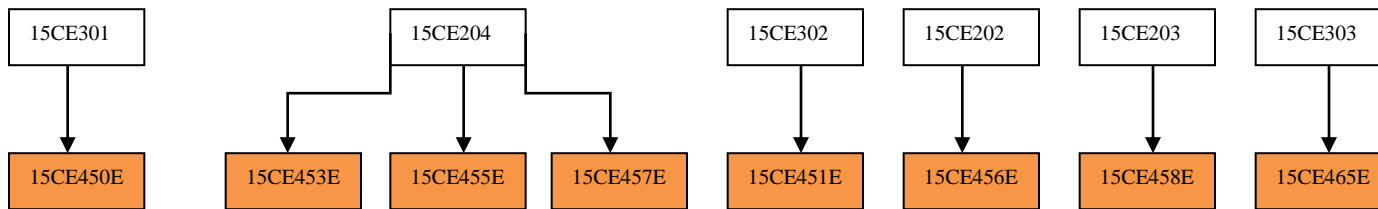
Elective IV- Structural Engineering   – Year – IV,

```
┌──────────┐┌──────────┐┌──────────┐┌──────────┐┌──────────┐
│15CE321E  ││15CE322E  ││15CE323E  ││15CE324E  ││15CE325E  │
└──────────┘└──────────┘└──────────┘└──────────┘└──────────┘
```
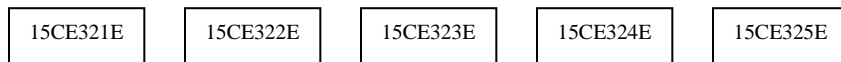
Elective V- GIS and Remote Sensing   – Year – IV,

15CE329E

Elective V- Rock Mechanics   – Year – IV,

| 15CE331E | 15CE332E | 15CE333E | 15CE334E | 15CE335E | 15CE336E | 15CE337E | 15CE338E |

| 15CE339E | 15CE340E | 15CE341E | 15CE342E | 15CE343E | 15CE344E | 15CE345E |

Elective V- Environmental Engineering   – Year – IV,

Legend

Courses which have prerequisites

15CE101	BASIC CIVIL ENGINEERING	L	T	P	C
		2	0	0	2
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	E ENGINEERING SCIENCES				
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	To get exposed to the glimpses of Civil Engineering topics that are essential for an Engineer.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES
At the end of the course, student will be able to		
1.	Know about different materials used in civil engineering structures in general	a
2.	Understand the engineering properties of material related to the design of civil engineering structural members	a
3.	Know about terms, definitions and uses related to multifarious building components.	a
4.	Learn the importance of surveying and the transportation systems	a
5.	Comprehend rudiments of engineering related to dams, water supply, and sewage disposal	a

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I- BUILDING MATERIALS	**6**			
1.	Introduction to Civil Engineering and Civil Engineering materials	1	C	1	1-3
2.	Composition, classifications, properties, and uses of stones	1	C	1	1-3
3.	Classification of rocks , quarrying , dressing , properties and uses	1	C	1	1-3
4.	Properties and uses of timber and ply wood	1	C	1	1-3
5.	Types, grades, properties and uses of cement and grade, designation, properties and uses of concrete	1	C	1	1-3
6.	Types of steel, mild, medium and hard, properties and uses and market forms	1	C	1	1-3
	UNIT II- MATERIAL PROPERTIES	**6**			
7.	Types of stresses and strains and Hook's law	1	C	2	1-3
8.	Three modulii of elasticity and Poisson's ratio and their interrelationship , simple problems	1	C, I	2	1-3
9.	Determination of centre of gravity of plane areas	1	C, I	2	1-3
10.	Concept of Moment of inertia, parallel and perpendicular axis theorems and the concept of radius of gyration	1	C	2	1-3
11.	Determination of moment of inertias of rectangular, circular, I , T and channel sections	2	C, I	2	1-3
	UNIT III -BUILDING COMPONENTS	**6**			
12.	Factors to be considered for site selection for buildings	1	C	3	1-3
13.	Classification of buildings and their components	1	C	3	1-3
14.	cement concrete, marble terrazzo , ceramic tiled floorings including the names of popular commercial brands	2	C	3	1-3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
15.	Requirements of roofing in buildings and corresponding classification of building roofs – RCC flat roofs and sheet roofings for pitched steel buildings.	2	C	3	1-3
	UNIT IV-SURVEYING AND TRANSPORTATION	**6**			
16.	Objectives, classification and principles of surveying	1	C	4	1-3
17.	Classification of transportation of and cross section and components of road	1	C	4	1-3
18.	Railway – cross section and components of permanent way and its functions	1	C	4	1-3
19.	Water way, docks and harbor their classifications and components.	2	C	4	1-3
20.	Components of bridge	1	C	4	1-3
	UNIT V- WATER SUPPLY AND SEWAGE DISPOSAL	**6**			
21.	Purpose of dams, types of dam, selection of site for the dams, and the cross section of gravity of dams	2	C	5	1-3
22.	Objectives of water supply, estimation of quantity of water, sources of water, standards of drinking water and distribution system	2	C	5	1-3
23.	Classification of sewage, technical terms and definitions, septic tank its components and functions.	2	C	5	1-3
Total contact hours		**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Raju .K.V.B, Ravichandran .P.T, "*Basics of Civil Engineering*", Ayyappa Publications, Chennai, 2012.
2.	Rangwala .S.C," *Engineering Material"s*, Charotar Publishing House, Anand, 2012.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "*Basic Civil Engineering*", Laxmi Publications, First edition (2003), New Delhi

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15AR101	PRINCIPLES OF ARCHITECTURE	L	T	P	C
		2	0	0	2
Co- requisite	NIL				
Pre requisite	NIL				
Databook/ codes/ Standards	NIL				
Course Category	PROFESSIONAL CORE				
Course designed by	Department of Architecture				
Approval	32nd Meeting of Academic Council, 2016				

PURPOSE	To instill a broad understanding about architecture in students of civil engineering			
	INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**		
1.	At the end of the course, student will be able to			
2.	Get awareness about design criteria, building bye laws, development control rules & zoning regulations.	a	c	
3.	Get an introduction to the basic architectural principles & imparting knowledge about building	a	j	
4.	Get an exposure to the basic architectural principles in functional planning	j		
5.	Acquire knowledge about building services .	h		

Session	Description of topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT 1-PLANNING ASPECTS & REGULATIONS	**10**			
1	Building types & design criteria	1	C	1	1,2,3
2	Space standards for residential	1	C	1	1,2,3
3	Space standards for commercial	2	C	1	1,2,3
4	Space standards for institutional categories	2	C	1	1,2,3
5	Building bye laws applicable for approval by the local governing body.	2	C, I	1	1,2,3
6	Development control rules for Chennai metropolitan area.	2	C, I	1	1,2,3
	UNIT II - ARCHITECTURAL PRINCIPLES	**10**		2,3	1,2,3
7	Introduction to architecture	1	C	2,3	1,2,3
8	Elements of architecture	3	C	2,3	1,2,3
9	Primary forms - organizing principles -	1	C	2,3	1,2,3
10	Proportion, scale, balance	2	C	2,3	1,2,3
11	Symmetry, hierarchy, axis	2	C	2,3	1,2,3
12	Building examples from historical & contemporary architecture.	1	C	2,3	1,2,3
	UNIT III - BUILDING SERVICES	**10**			1,2,3
13	Integration of services in buildings	1	C	4,5	1,2,3
14	Water supply & plumbing layout for a residential building	2	C, I	4	1,2,3,4

15	Basic components of the electrical system for a residence - typical electrical layout diagram.	2	C,I	4	1,2,3,4
16	Elevators & escalators - planning & installation	3	C,I	4	1,2,3,4
17	Lay out of external services -water supply	1	C	4	1,2,3,4
18	Sewage disposal-electrical cabling.	1	C		1,2,3,4
TOTAL CONTACT HOURS		**30**			

LEARNING RESOURCES	
SL.NO	**TEXT BOOKS**
1	Francis .D.K Ching- "Architecture: Form Space & Order" Van Nastrand Reinhold, 1996
2	Vaidyanathan .G, Kulasekaran .I, Sathishkumar .G, "Building planning & construction companion", Edifice Institute of Building services publication,2002
REFERENCES	
3	Joseph De chiara& John Callendar – "Time saver standards for building types", III Edition - Mc Graw Hill, 1990
4	National Building Code, "Bureau of Indian Standars", New Delhi, 2005

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE102	ELEMENTS OF BUILDING MATERIAL SCIENCE	L	T	P	C
		2	0	0	2

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL

Course Category	P	PROFESSIONAL CORE	CONSTRUCTION MANAGEMENT
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	To develop knowledge of conventional and new materials of construction.
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**

At the end of the course, student will be able	
1.	To learn the manufacturing process, types, applications and testing procedures for materials used for load bearing purpose	a
2.	To know about materials that is used for protection and functional purpose	e
3.	To impart knowledge about basis of recent paradigms, and new materials	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I -BASIC LOAD BEARING MATERIALS	**6**			
1.	Conventional Materials: Stones: classification of rocks – quarrying – dressing	2	C	3	1,2,3
2.	Properties and uses of stones – tests for stones. Bricks: composition – manufacture – four operations – classification and uses	2	C	3	1,2,3
3.	Timber: classification of trees	1	C,O	3	1,2,3
4.	Structure of tree – methods – wood product – uses.	1	C	3	1,2,3
	UNIT II: -ADVANCED LOAD BEARING MATERIALS	**6**			
5.	Cement: Introduction – ingredients – manufacture – dry and wet process – types of cement	2	C,I	1,3	2,3
6.	Properties – uses – tests for cement. Mortar: functions – requirements – types – properties – uses – tests on mortar.	1	C	1,3	2,3,4
7.	Steel: introduction – types – properties – uses – market forms. Concrete: Ingredients – functions – w/c ratio – grades – admixture	2	C	1,3	2,3
8.	Test on concrete – properties – uses. RCC: Characteristics – elements - advantages – disadvantage	1	C	1,3	2,3,4
	UNIT III: - SPECIAL CONSTRUCTION MATERIALS	**6**			
9.	Prestressed concrete – types – properties – uses – merits and demerits. Ferro cement – advantages – uses	1	C	1,3	2,3,4
10.	Fibre reinforced concrete – types of fibres – steel fibres – SFRC – properties – applications.	1	C,I	1,3	2,3
11.	Lightweight concrete – types. High density concrete, High strength concrete	2	C,O	1,3	2,3
12.	Advantages – applications, High performance concrete – properties	2	C	1,3	1,2,3
	UNIT IV: NON LOAD BEARING MATERIALS	**6**			
13.	Paints: Functions – constituents – characteristics – selection – types of paints – defects	2	C	2,3	2,3
14.	Varnishes: Elements – properties – types. Distempers:	2	C	2,3	1,2,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	composition – properties.				
15.	Asbestos: Properties – uses – asbestos cements products. Glass: Constituents – composition – classification – properties –market form – uses	1	C	2,3	2,3
16.	Plastic: constituents – classification – properties – uses.	1	C	2,3	1,2,3
	UNIT V: RECENT CONSTRUCTION MATERIALS	**6**			
17.	Reactive powder concrete – properties, Geopolymer concrete – advantages	2	C,O	3	2,3,5,6
18.	Blended cement concrete – use of mineral admixtures – properties, Self health monitoring concrete	1	C	3	2,3,4
19.	Bacterial concrete, Roller compacted concrete - uses, Self-compacting concrete – properties – advantages	2	C	3	2,3,5
20.	Ready mixed concrete – advantages.	1	C	3	5, 6, 7
	Total contact hours	**30**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1	Varghese .P.C, "*Building Materials*", Prentice Hall India,2010.
2	Raju .K.V.B, Annadurai .R and Ravichandran.P.T, "*Construction Materials*", Ayyappaa Publications, Chennai, 2012
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Surendra Singh, "*Building Materials*", Vikas Publishing Company, New Delhi, 1996.
4.	Rangwala .S.C, "*Engineering Materials*", Charotor Publishing House, New Delhi, 2012.
5.	"*Lecture Notes on Special Concretes, Special Concrete,*" Department of Civil Engineering, SRM Engineering College, Kattankulathur 2007.
6.	Shetty .M.S, "*Concrete Technology*", S.Chand and Company, New Delhi, 2010
7.	Gurucharan Singh, "*Building Construction and Materials*", Standard Book House, Delhi, 1988
8.	P.Purushothama Raj**,** *"Building Construction Material and Techniques"*, Pearson India Education services, - 2016.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage:			**50%**

15CE201		ENGINEERING GEOLOGY	L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	B	BASIC SCIENCE				
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To understand the basics and application of engineering geology technology					
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**				
At the end of the course, student will be able						
1.	To study the origin, development and ultimate fate of various surface features of the earth	a	d	e	h	k
2.	To understand the basic building units of which the solid crust of the earth	a	d	e	h	k
3.	To understand the nature of geographic distribution of rocks and engineering properties of rock on the earth	a	d	e	h	k
4.	To understand the nature of geological structures and their importance on the civil engineering structures	a	d	e	h	k
5.	To know the importance of geology in civil engineering practices	a	d	e	h	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I- - GENERAL GEOLOGY	**9**			
1.	Fundamentals of Geology	1	C D	1	1,2
2.	Earth Structure - Lithosphere	1	C	1	1,2
3.	Scope of Geology in Engineering	1	C,D	1	1,2
4.	Internal structure of the earth Composition	1	C,D	1	1,2
5.	External Agencies Weathering, Geological work of Wind	1	C,D	1	1,2
6.	Geological work of River,	1	C,D	1	1,2
7.	Geological work of Sea and Landslide	1	C,D	1	1,2
8.	Internal Agencies - Earthquake, Plate Tectonics	1	C,D	1	1,2
9.	Geological work of Ground Water	1	C,D	1	1,2
	UNIT II: MINERALS OF THE EARTH'S CRUST	**9**			
10.	Rock Forming Minerals	1	C,D	2	1,2
11.	Physical Properties of Minerals	2	C,D	2	1,2
12.	Quartz group	1	C,D	2	1,2
13.	Feldspar group	1	C,D	2	1,2
14.	Mica - Calcite	1	C,D	2	1,2
15.	Clay Minerals and its importance	1	C,D	2	1,2,3
16.	Indian resource of Coal	1	C,D	2	1,2,3
17.	Indian resource of Petroleum	1	C,D	2	1,2,3
	UNIT III - ROCKS OF THE EARTH'S CRUST	**9**			
18.	Introduction to Rocks and their study - Rock Cycle	1	C,D	3	1,2
19.	Igneous Rocks	1	C,D,I	3	1,2,4
20.	Sedimentary Rocks	1	C,D	3	1,2,4
21.	Metamorphic Rocks	1	C,D	3	1,2,4
22.	Engineering Properties, Uses and Indian Occurrence of the Igneous rocks - Granite,	1	C,I	3	1,2,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Diorite				
23.	Engineering Properties, Uses and Indian Occurrence of the Igneous rocks -, Dolerite, Pegmatite, Basalt	1	C,I	3	1,2,4
24.	Engineering Properties, Uses and Indian Occurrence of the Sedimentary rocks- Shale, Sandstone, Limestone	1	C,I	3	1,2,4
25.	Engineering Properties, Uses and Indian Occurrence of the Sedimentary rocks-, Breccia and Conglomerate	1	C,I	3	1,2,4
26.	Engineering Properties, Uses and Indian Occurrence of the Metamorphic rocks Gneiss, Schist, Slate, Quartzite and Marble	1	C,I	3	1,2,4
	UNIT IV - STRUCTURAL FEATURES OF ROCKS	**9**			
27.	Introduction - Terminology in Structural Geology	1	C	4	1,2,5
28.	Outcrop - Geological Map - Clinometer	2	D,I	4	1,2,5
29.	Geological Structures - Folds	2	D,I	4	1,2,5
30.	Geological Structures - Fault	2	D,I	4	1,2,5
31.	Geological Structures - Joints	1	D,I	4	1,2,5
32.	Engineering Considerations involves Structures.	1	D,I	4	1,2,5
	UNIT V - GEOLOGY FOR ENGINEERING PROJECTS	**9**			
33.	Geological Investigations-Direct and Indirect Methods	1	C,D,I	5	1
34.	Geophysical Investigations–Electrical and Resistivity Survey,	1	C,D	5	1
35.	Seismic Investigation, Gravitational techniques ,	1	C,D	5	1
36.	Remote Sensing Techniques	1	C,D	5	1
37.	Geological Considerations for Dam Reservoirs	1	C,D	5	1
38.	Geological Considerations for Tunnels and Road Cuts	1	C,D	5	1
39.	Practice in Geology - Demonstration for Clinometer	1	C,D,I	5	1
40.	Geological Maps	1	C,D,I	5	1
41.	Identification of Crystals, Minerals and Rocks	1	C,D,I	5	1
	Total contact hours		**45**		

	LEARNING RESOURCES	
Sl.No.	TEXT BOOKS	
1.	Garg .S.K, "*Physical and Engineering Geology",* Khanna Publication, New Delhi, 1999 .	
2.	Parbin Singh, "*Engineering and General Geology",* Katson Publication House, 2010 .	
	REFERENCE BOOKS/OTHER READING MATERIAL	
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	

Course nature				Theory		
Assessment Method (Weight age 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weight age	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weight age :			**50%**

15CE203		MECHANICS OF SOLIDS		L	T	P	C
				2	2	0	3

Co-requisite:	NIL	
Prerequisite:	NIL	
Data Book / Codes/Standards	NIL	
Course Category	P	PROFESSIONAL CORE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering	
Approval	32nd Academic Council Meeting , 2016	

PURPOSE	To know the basics of solid mechanics. To understand the concepts of mechanics of structures. To understand the behaviour, determine the internal forces and analyse the stresses of various structural elements under action of different types of forces.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Resolution of forces and to comprehend free body diagrams; determination of stresses and strains	a	e
2.	Analyse the state of stress (two and three dimensional) and evaluate the principal stresses and principal planes by analytical and graphical treatment	a	e
3.	Determination of centre of gravity for plane areas and solids; determination of the moment of inertia of plane areas and mass moment of area of solids.	a	e
4.	Study the behaviour of determinate beams and examine the internal forces, stresses induced and learn the theory of torsion and stresses developed in solid, hollow shafts and helical springs	a	e
5.	Analyse and determine the internal forces in pin jointed plane trusses by various methods	a	e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I- BASICS OF MECHANICS, STRESS, STRAIN AND DEFORMATION OF SOLIDS	**15**			
1.	Vectors, Concept of forces, Concept of particle and rigid body, Non-concurrent and parallel forces in a plane.	2	C	1	1,2,5,6
2.	Moment of force and Varignon's theorem	2	C	1	1,2,5,6
3.	Free body diagram-conditions of equilibrium, Principle of virtual work, equivalent force system	2	C	1	1,2,5,6
4.	Rigid bodies and deformable solids, tension, compression and shear stresses	2	C	1	1-6
5.	Longitudinal strain, Lateral strain, Poisson's ratio and Volumetric strain	2	C	1	1-6
6.	Deformation of simple and compound bars, Elastic constants	3	C	1	1-6
7.	Composite sections and Thermal stresses.	2	C,I	1	1-6
	UNIT II- ANALYSIS OF STATE OF STRESS	**10**			
8.	Two Dimensional Stresses on inclined planes and Combined stresses	2	C	2	3,4
9.	Principal stresses and Principal planes	3	C	2	3,4
10.	Mohr's circle of stress	1	C	2	3,4
11.	Spherical and Deviatric components of stress tensor	2	C	2	3,4
12.	Determination of Principal stresses and Principal planes	2	C, I	2	3,4
	UNIT III: CENTRE OF GRAVITY AND	**10**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	MOMENT OF INERTIA				
13.	Areas and volumes, Theorems of Pappus and Guldinus, Centroid of simple areas and volumes by integration, Centroid of composite areas	2	C, I	3	1-6
14.	Second and product moment of areas, radius of gyration, parallel axis and perpendicular axis theorems,	2	C, I	3	1-6
15.	Moment of Inertia of simple areas by integration	2	C, I	3	1-6
16.	Moment of inertia of composite areas	2	C, I	3	1-6
17.	Mass moment of inertia of thin plates and simple solids.	2	C, I	3	1-6
	UNIT IV: BENDING OF BEAMS AND TORSION OF SHAFTS	**15**			
18.	Beams, Types of Support and Types of load	1	C, I	4	3,4
19.	S.F and B.M in beams, Cantilevers and Simply supported beams with different types of loading	3	C, I	4	3,4
20.	S.F and B.M in Overhanging beams with different types of loading, Relationship between B.M and S.F.	1	C, I	4	3,4
21.	Theory of simple bending, Bending stresses, analysis of stresses, load carrying capacity and Proportioning of sections	2	C, I	4	3,4
22.	Shear stress distribution for various Cross sections, Shear flow, beams of uniform strength.	2	C, I	4	3,4
23.	Theory of pure torsion, Stresses and deformation in Circular solid and Hollow shafts	2	C, I	4	3,4
24.	Power transmitted by shafts and determination of stresses	2	C, I	4	3,4
25.	Stresses in helical springs, Deflection of springs	2	C, I	4	3,4
	UNIT V: ANALYSIS OF STATICALLY DETERMINATE PLANE TRUSSES	**10**			
26.	Stability and Equilibrium of plane frames, Types of Trusses, Perfect frames	2	C, I	5	3,4
27.	Analysis of forces in truss members, Method of joints	4	C, I	5	3,4
28.	Analysis of forces in truss members, Method of Sections	3	C, I	5	3,4
29.	Principles of Graphical Method for the analysis of trusses	1	C	5	3,4
	Total contact hours	**60**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Punmia.B.C, Ashok Kumar Jain, Arun Kumar Jain, "*Mechanics of Materials*", Laxmi Publications (P) Ltd., 2003.
2.	Timoshenko.S.P and Gere.J.M, "*Mechanics of Materials*", A&C, Black 2 Ed. 1990.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Rajput.R. K, "*Strength of Materials: Mechanics of Solids*", Edition 4, S. Chand Limited, New Delhi, 2007.
4.	Ramamrutham.S, Narayan.R, "*Strength Of Materials*", Dhanpat Rai Publishing Company (P) Limited, 2008.

5.	Rajasekaran.S, "*Engineering Mechanics: Statics And Dynamics*", 3E, Vikas Publishing House Pvt Limited, 2009.
6.	Beer and Johnson, "*Mechanics for Engineers, Statics and Dynamics*", Mc Graw Hill Book Company, 1987.
7.	Dongre, A.P., "Strength of Material". Scitech publication India. 2nd Edition, August , 2014
8.	Bhavikatti, S.S., "Solid Mechanics", Vikas publishing -2010

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE203L	STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	4	2

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To be exposed to testing of different materials under the action of various forces and to determine the characteristics experimentally.			
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able to				
1.	Learn the properties of different materials like steel, concrete, brick etc.,	a	b	k
2.	Study the behaviour of different structural elements by conduct of different tests like tension, compression, double shear, flexure etc.,	a	b	k
3.	Study the non-destructive test on concrete cubes	a	b	k

Sl. No	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Tension test on mild steel and H.T.S rods – under load control and displacement control	6	O	1,2	1
2.	Double shear test on mild steel rods	6	O	1,2	1,3
3.	Hardness test on metals like mild steel, brass, copper and aluminimum	6	O	1,2	1
4.	Torsion test on mild steel rods	6	O	1,2	1
5.	Impact test on metal specimens - Charpy and Izod test	6	O	1,2	1,5,6
6.	Compression tests on wood specimen, bricks & concrete cubes including displacement control	6	O	1,2	1,2
7.	Tests on helical springs	6	O	1,2	1
8.	Deflection test on steel, aluminimum and timber beams	6	O	1,2	1
9.	Non Destructive Test on Concrete Cubes (Rebound Hammer and Ultrasonic Pulse Velocity)	6	O	1,2,3	1,4
10.	Flexure test on steel and timber beams with strain/deflection measurements	6	O	1,2	1
	Total contact hours	**60**			

LEARNING RESOURCES	
Sl.No.	REFERENCES
1.	Laboratory Manual
2.	IS:516-1987*, "Methods of Test for Strength of Concrete,"* BIS, New Delhi.
3.	IS:5242-1979*, "Methods of Test for Determining Shear Strength of Metals,"* BIS, New Delhi.
4.	IS:13311 (Part 2) -1992*, "Non Destructive Test of Concrete - Methods of Test,"* BIS, New Delhi.
5.	IS:1598 -1977*, "Method for Izod Impact Test for Metals,"* BIS, New Delhi.
6.	IS:1757 – 1988*, "Charpy Impact Test (V-Notch) on Metallic Material,"* BIS, New Delhi.

Course nature				Practical		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
				End semester examination Weightage :		**40%**

CE-Engg&Tech-SRM-2015

15CE205	FLUID MECHANICS	L	T	P	C
		3	0	0	3

Co-requisite:	NIL		
Prerequisite:	NIL		
Data Book / Codes/Standards	NIL		
Course Category	P	PROFESSIONAL CORE	WATER RESOURCES ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	The purpose of this course is to learn fundamental concepts in the field of fluid mechanics

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES			
At the end of the course, student will be able					
1.	To learn the importance, application and inter-relationship of various properties of fluid like mass density, viscosity, and surface tension.	a	e		
2.	To determine the forces on plane and curved surfaces in a fluid at rest and the concepts of buoyancy and metacentre.	a	e		
3.	To study the properties of a moving fluid like velocity and acceleration, and the forces on fluid through the continuity equation, Euler's and Bernoulli's equations.	a	e		
4.	To study laminar and turbulent flow in pipes, major and minor losses in pipes.	a	e	k	
5.	To study the fundamentals of dimensional analysis and model studies.	a	e	k	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I -FLUID PROPERTIES	**7**			
1.	Importance and application of fluid mechanics	1	C	1	1-4
2.	Fluid properties – Density ,Specific weight, Specific volume, Specific Gravity– Viscosity- Newton's law of Viscosity -Kinematic Viscosity	3	C,I	1	1-5
3.	Surface Tension- Liquid droplet, Hollow bubble, Liquid jet, Capillarity – Capillary Rise and Fall	2	C,I	1	1-5
4.	Vapor Pressure - Compressibility and Bulk Modulus	1	C,I	1	1-5
	UNIT II – FLUID STATICS	**9**			
5.	Pascal' law – Law of Hydrostatics	1	C,I	2	1-5
6.	Forces on plane – Horizontal, Vertical and Inclined and Curved surfaces	5	C,I	2	1-5
7.	Buoyancy- Center of Buoyancy – Meta center – Meta centric Height	2	C,I	2	1-5
8.	Stability of floating and submerged bodies	1	C,I	2	1-5
	UNIT III – FLUID KINEMATICS AND FLUID DYNAMICS	**10**			
9.	Velocity and Acceleration – Local and Convective acceleration - Classification of flows – Continuity equation	3	C,I	3	1-5
10.	Stream, Streak and Path line – Velocity Potential function and Stream Function- Equipotential line -	3	C,I	3	1-4

CE-Engg&Tech-SRM-2015

	Flow net analysis				
11.	Control volume – Euler and Bernoulli's equation	3	C,I	3	1-5
12.	Free and Forced vortex motion.	1	C	3	1-4
	UNIT IV – FLOW THROUGH PIPES	**11**			
13.	Definition of boundary layer – Laminar and turbulent flows	1	C	4	1-4
14.	Reynold's experiment – Darcy-Weisbach equation – Moody diagram	2	C,I	4	1-4
15.	Friction factor – Major and Minor losses – HGL and TEL	4	CI	4	1-4
16.	Pipes in series and parallel – Equivalent pipe	2	C,I	4	1-4
17.	Pipe network- Hardy cross method.- Introduction to software to analyse water distribution modeling	2	C,I	4	1-4
	UNIT V – DIMENSIONAL AND MODEL ANALYSIS	**8**			
18.	Units and Dimensions - Dimensional homogeneity	2	C,I	5	1-4
19.	Rayleigh's method – Buckingham's Pi theorem	2	C,I	5	1-5
20.	Model Analysis -Hydraulic similitude – Dimensionless numbers -Model laws	3	C,I	5	1-4
21.	Model studies- Distorted and Undistorted	1	C,I	5	1-4
	Total contact hours			**45**	

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Modi .P.N and.Seth .S.M, *"Hydraulics and Fluid Mechanics"*, Standard Book House, 2001.
2.	Rajput .R.K, *"Fluid Mechanics and Hydraulic Machines"*, S.Chand and Company Ltd.,2005
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Bansal .R.K, *"Fluid Mechanics and Hydraulic Machines"*, Laxmi Publications, Ninth Edition, 2010
4.	Kumar .K.L, *"Engineering Fluid Mechanics"*, Eurasia Publishing House, 2002
5.	http://nptel.ac.in/courses/105103095/1-101

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE207		ENGINEERING SURVEYING	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P	PROFESSIONAL CORE	GEOMATICS ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To measure the land area, to prepare map and to find out the elevation of a point for constructional purpose.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES		
At the end of the course, student will be able				
1.	To measure the land area by chaining, compass and plane table.	a	e	j
2.	To measure the elevation of points using dumpy level.	a	b	j
3.	To measure the height and distance by theodolite.	a	b	j
4.	To know about the application of tacheometric surveying.	a	b	j
5.	To know about the curves, contouring and setting out works for construction purposes.	a	b	j

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
1.	**UNIT I: CHAIN, COMPASS AND PLANE TABLE SURVEYING**	**11**			
2.	Chain: Definition – Principles – Classification – .	2	C,D	1,4	1,2
3.	Field and office work – Conventional signs	1	C,D	1,4	1,2
4.	Ranging and chaining – Reciprocal ranging – Setting perpendiculars- Well- conditioned triangles	1	C,D	1,4	1,2,
5.	Compass: Prismatic compass – Surveyor's compass	2	C,D	1,4	1,2,6,7
6.	Bearing systems and conversions – Local attraction	2	C,D	1,4	1,2,6,7
7.	Magnetic declination – dip – Traversing – Plotting – Adjustment of error	1	C,D	1,4	1,2,6,7
8.	Plane Table Surveying: Plane table instruments and accessories – merits and demerits – methods –	1	C,D	1	1,2,6,7
9.	Radiation- Intersection – Resection – Traversing.	1	C,D	1	1,2,6,7
10.	**UNIT II: LEVELLING**	**9**	C,D	1	1,2,3,4,
11.	Level line – Horizontal line	2	C, D	2	1,3,4,6
12.	Levels and Staves – Spirit level – sensitiveness – Bench marks	2	C, D	2	1,2,3,4,
13.	Temporary and Permanent adjustments	1	C, D	2	1,2,3,4,
14.	Fly and check levelling – Booking – Reduction	2	D,I	2	1,2,3,4,
15.	Curvature and Refraction	1	D,I	2	1,2,3,4,
16.	Reciprocal levelling – Longitudinal and Cross sections – Plotting	1	D,I	2	1,2,3,4,
17.	**UNIT III: THEODOLITE SURVEYING**	**8**			
18.	Theodolite – Vernier and Microptic – Description and uses.	2	C,D,I	4	1,2,5,7
19.	Temporary and Permanent adjustments of	2	C,D,I	4	1,2,5,7

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	vernier transit				
20.	Horizontal angles – Heights and Distances – Traversing	1	C,D,I	4	1,2,5,7
21.	Closing error and distribution	1	C,D,I	4	1,2,5,7
22.	Trigonometric levelling	2	C,D,I	4	1,2,5,7
23.	**UNIT IV: TACHEOMETRIC SURVEYING**	**8**			
24.	Tacheometric Systems – Tangential, Stadia and subtense methods	2	C	4	3,6,7
25.	Stadia systems – horizontal and inclined sights – vertical and normal staff	3	D,I	4	3,6,7
26.	Fixed and movable hair – stadia constants, anallatic lens	2	D,I	4	3,6,7
27.	Subtense bar- Self reducing tacheometers	1	D,I	4	3,6,7
28.	**UNIT V: ENGINEERING SURVEYS**	**9**			
29.	Reconnaissance, Preliminary and location surveys for engineering projects – layout – setting out works-	3	D,I	4	3,4,5,7
30.	Curves- Curve ranging – Horizontal and Vertical curves – Simple curves –setting with chain and tapes, tangential angles by theodolite –	2	C	4,5	3,4,5,7
31.	compound and reverse curves – Transition curves	1	I, O	5	3,4,5,7
32.	Contours- Contouring – Methods – Characteristics and uses of contours –	2	C	5	3,4,5,7
33.	Plotting – Calculation of areas and volumes.	1	I, O	5	3,4,5,7
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Kanetkar .T.P,"*Surveying and Levelling*," Vols. I and II, United Book Corporation, Pune, 2007.
2.	Punmia .B.C,"*Surveying*," Vols. I ,Laxmi Publications,Seventeenth edition,2016.
3.	Chandra .A.M, "*Plane Surveying* and *Higher Surveying*", New Age International (P) Limited, Publishers, Chennai, 3rd Edition 2015.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Punmia .B.C,"*Surveying*," Vols. II, Laxmi Publications, Sixteenth edition,2016
5.	James M. Anderson and Edward M. Mikhail, "*Introduction to Surveying*," McGraw Hill Book Company, Third Edition, 2001.
6.	Clark.D, "*Plane and Geodetic Surveying*", Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Seventh Edition, 2002.
7.	Arora .K.P, "*Surveying*", Volume 3, Standard Book House, 11th edition, 2013.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE207L		SURVEYING LABORATORY		L	T	P	C
				0	0	4	2

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	Survey Laboratory Manual
Course Category	P PROFESSIONAL CORE GEOMATICS ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To measure the land area, preparation of map, elevation of point, setting out works by practical work.

INSTRUCTIONAL OBJECTIVES			STUDENT OUTCOMES			
At the end of the course, student will be able						
1.	To study the practical experiments in chaining, compass, plane table.		a	g	j	k
2.	To study the practical application of levelling and theodolite.		a	g	j	k
3.	To gain experience in handling surveying equipments and help in Civil Engineering career.		a	g	j	k

Sl.No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Simple chain survey – calculation of area using cross staff-Perpendicular off Set	3	I-O	1, 3	1
2.	Simple chain survey – calculation of area using cross staff-oblique off Set	3	I-O	1, 3	1
3.	Simple chain survey—Measurement of Obstacle Length	3	I-O	1, 3	1
4.	Traversing - Measurement of bearing of survey lines by prismatic compass -Correction of Local Attraction	3	I-O	1, 3	1
5.	Traversing -- prismatic compass --Running closed and open compass traverse- Plotting and adjustments of traverse.	6	I-O	1, 3	1
6.	Plane table survey by Radiation methods.	3	I-O	1, 3	1
7.	Plane table survey by Intersection methods	3	I-O	1, 3	1
8.	Resection: Field solution of two point problems.	6	I-O	1, 3	1
9.	Resection: Field solution of three point problems (any one method).	3	I-O	1, 3	1
10.	Reduction of levels : (i) Height of collimation method	3	I-O	2,3	1
11.	Reduction of levels : (ii) Rise and Fall method	3	I-O	2,3	1
12.	Theodolite - Measurement of horizontal angles by reiteration.	6	I-O	2,3	1
13.	Theodolite - Measurement of horizontal angles by repetition.	6	I-O	2,3	1
14.	Theodolite - Measurement of vertical angles and determination of height of an object.	3	I-O	2,3	1
15.	Heights and distances: Single plane method.	3	I-O	2,3	1

16.	Heights and distances : Double plane method	3	I-O	2,3	1
	Total contact hours	**60**			

LEARNING RESOURCES	
Sl.No.	**REFERENCES**
1.	Surveying Laboratory Manual

Course nature				Practical		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
				End semester examination Weightage :		**40%**

15CE209		CONSTRUCTION TECHNOLOGY	L	T	P	C
			1	2	0	2

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE CONSTRUCTION MANAGEMENT
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	It is aimed to develop a thorough understanding of the basics of building components and its construction.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES			
At the end of the course, student will be able to					
1.	To build an awareness about the type of masonry, floors, and roofs	a	d	k	
2.	To understand types of doors and stairs and its uses	a	d	k	
3.	To know about the supporting structures and building amenities.	a	d	k	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I - GENERAL	**9**			
1	Principles of Planning - Planning Regulations and laws	2	C,I	3	1,2,3
2	Housing Analysis- Role and Uses of Computers in Planning	2	C,I	3	1,2,3
3	Orientation of Building – Functional Requirements of a Building	3	C,I	3	1,2,3
4	Types of Plans.	2	C,I	3	1,2,3
	UNIT II: - MASONRY	**9**			
5	Masonry - Stone Masonry - Rubble and Ashlars Masonry -	3	C,I	1,3	2,3
6	Brick Masonry - Bond - Types of bonds - English and Flemish bond	2	C,I	1,3	2,3
7	Composite masonry – Stone masonry-Concrete Masonry- Reinforced masonry	2	C,I	1,3	2,3
8	Types of walls-Types of Partition walls.	2	C,I	1,3	2,3
	UNIT III: - FLOORS AND ROOFS	**9**			
9	Floors - Types of floor - Details of concrete and Terrazzo floors –Flooring Tiles with commercial Names	2	C,I	1,3	2,3
10	Roofs - Types of Roofs - Flat roofs – Sloping roofs - Shell Roofs - Roof coverings-AC sheets-GI sheets	2	C,I	1,3	2,3
11	Lintels -Classification of lintels- Arches - Classification of arches	2	C,I	1,3	2,3,5
12	Types of weathering courses- Damp proofing- Methods of damp proofing.	1	C,I	1,3	2,3,5
13	Anti Termite Treatment - Pre-Construction &Post Construction Termite Control	2	C,I	1,3	4
	UNIT IV: STAIRS AND SUPPORTING STRUCTURE	**9**			
14	Staircase - Types of staircase	2	C,I	2,3	2,3,5
15	Types of doors and windows - Wooden and metallic door frames-Ventilators	2	C,I	2,3	2,3,5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
16	Fixtures and fastening for doors –PVC doors and windows	1	C,I	2,3	2,3,6
17	Shoring-Types-Underpinning-Types-Scaffolding-Components	2	C,I	2,3	2,3,6
18	Types-Form work- From work for columns, beam, stairs, walls	2	C,I	2,3	2,3,6
	UNIT V: - BUILDING AMENITIES	**9**			
19	Thermal insulation- Heat transference - Insulating material -	2	C,I	3	2,3,5
20	Method of application - Ventilation - Requirements - Types of ventilation - Air conditioning	2	C,I	3	2,3,5
21	Fire proof construction methods-Fire alarms	1	C,I	3	2,3,5
22	Principles of acoustical design of building- Sound insulation-materials and methods	2	C,I	3	1,2,3
23	Painting – surface area calculation	2	C,I	3	8
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1	Varghese .P.C,"*Building Construction*", Prentice Hall India, 2011.
2	Arora and Bindra .S.P, "*Building Construction, Planning Techniques and Method of Construction*", Dhampatrai sons, New Delhi, 2008.
3	Punmia B.K., Ashok Kumar Jain, Arn Kumar Jain, "*Building Construction*", Laxmi Publications Pvt. Ltd., New Delhi, 2008.
4	IS 6313 (part 2) :2001, Code of practice for anti-termite measures in buildings. Bureau of Indian standards , New Delhi.
	REFERENCE BOOKS/OTHER READING MATERIAL
5	National Building Code, Bureau of Indian Standards, New Delhi, 2005.
6	Chudley. R, Construction Technology, ELBS Publishers, 2007.
7	Gurucharan Singh, "*Building Construction and Materials*", Standard Book House, Delhi, 2008.
8	Asian Paint Manual.
9	Purushothama Raj, P.,"Building Construction Material and Techniques", Pearson India Education services, - 2016.

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE202	STRENGTH OF MATERIALS	L	T	P	C
		2	2	0	3

Co-requisite:	NIL			
Prerequisite:	15CE203			
Data Book / Codes/Standards	NIL			
Course Category	P	PROFESSIONAL CORE	STRUCTURAL ENGINEERING	
Course designed by	Department of Civil Engineering			
Approval	32nd Academic Council Meeting , 2016			

PURPOSE	To study advanced concepts in strength of materials like deflection, energy principles, stability criteria, theories of failure, unsymmetrical bending, behaviour of curved bars and locating shear centre.

INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**	
At the end of the course, student will be able to		
1.	Determine the deflections in beams by various methods like Macaulay's, Area Moment method and conjugate beam method.	a	e
2.	Analyse the structural elements by energy concepts and find stresses and deflections.	a	e
3.	Study Euler's, Rankine's and other theories of columns.	a	e
4.	Study various theories of failure in designing the structural members.	a	e
5.	Understand advanced concepts like unsymmetrical bending, stresses in curved bars and locating shear centre and stresses in thick cylinders.	a	e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I- DEFLECTION OF BEAMS	**15**			
1.	Determination of deflection curve	2	C,I	1	1-7
2.	Computation of Slopes and Deflections in Beams using Double Integration Method	2	C,I	1	1-7
3.	Computation of Slopes and Deflections in Beams using Macaulay's method	3	C,I	1	1-7
4.	Computation of Slopes and Deflections in Beams using Moment Area Method	2	C,I	1	1-7
5.	Computation of Slopes and Deflections in Beams using Conjugate Beam Method	3	C,I	1	1-7
6.	Effect of shear on Deflection and Deflection of leaf springs	3	C,D,I	1	1-7
	UNIT II- ENERGY PRINCIPLES	**15**			
7.	Concept of Strain energy and Strain energy density	1	C,I	2	2,3,7
8.	Strain energy due to Axial Load and Flexure	3	C,I	2	2,3,7
9.	Strain energy due to Shear and Torsion	2	C,I	2	2,3,7
10.	Concept of Strain energy and complimentary strain energy	1	C,I	2	2,3,7
11.	Castigliano's, Engessor's Energy theorems and Principle of virtual Work	2	C,I	2	2,3,7
12.	Application of Energy theorem for computing deflection in beams	2	C,I	2	2,3,7
13.	Application of Energy theorem for computing deflection in pin jointed plane frames and rigid plane frames (Determinate structures), Dummy Unit Load Method	2	C,I	2	2,3,7
14.	Williot Mohr's diagram and Maxwell's reciprocal theorem	2	C,I	2	2,3,7

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT III: COLUMNS	**10**			
15.	Euler's theory of long columns, Critical loads for Prismatic columns with different end conditions (Both the ends Hinged and Both the ends Fixed)	2	C,D,I	3	3,4,5
16.	Euler's theory of long columns, Critical loads for Prismatic columns with different end conditions (One End Fixed and the other end hinged, One End fixed and the other end free)	2	C,D,I	3	3,4,5
17.	Rankine Gordon's formula and Secant formula for eccentrically loaded long columns	3	C,D,I	3	3,4,5
18.	Combined bending and axial load, IS code recommendations	3	C,D,I	3	3,4,5
	UNIT IV: THEORIES OF FAILURE	**10**			
19.	Maximum Principal stress theory (Rankine's Theory) in application in analysis of stress	2	C,I	4	3
20.	Maximum shear stress theory (Guest's or Tresca's Theory) in application in analysis of stress	2	C,I	4	3
21.	Strain energy theory (Haigh Theory) in application in analysis of stress	2	C,I	4	3
22.	Distortion energy theory (Von Mises – Henky Theory) in application in analysis of stress	2	C,I	4	3
23.	Principal strain theory (St.Venant's Theory) in application in analysis of stress.	2	C,I	4	3
	UNIT V: SPECIAL TOPICS	**10**			
24.	Product Moment of Inertia and Principle Moment of Inertia	1	C,I	5	3,7
25.	Unsymmetrical bending of Beams of Symmetrical and Unsymmetrical Sections (Only angle sections)	2	C,I	5	3,7
26.	Box Sections and its importance, Analysis of Curved bars using Winkler Bach formula	2	C,I	5	3,7
27.	Concept of shear centre, Analysis of sections for Shear Centre simple problems on channel sections only	1	C,I	5	3,7
28.	Thin Cylinders and spherical Shells, Deformation of thin Shells, Stresses at a point in thin shells	2	C,I	5	3,7
29.	Analysis for Stresses for Thick cylinders and concept of shrink fit in compound cylinders	2	C,I	5	3,7
	Total contact hours	**60**			

	LEARNING RESOURCES
Sl.No.	**TEXT BOOKS**
1.	Punmia .B.C, Ashok Kumar Jain, Arun Kumar Jain, "*Mechanics of Materials*", Laxmi Publications (P) Ltd., 2003.
2.	Timoshenko.S.P and Gere.J.M, "*Mechanics of Materials*", A&C, Black 2 Ed. 1990.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Rajput.R. K, "*Strength of Materials: Mechanics of Solids*", Edition 4, S. Chand Limited, New Delhi, 2007.
4.	Ramamrutham.S, Narayan.R, "*Strength of Materials*", Dhanpat Rai Publishing Company (P) Limited, 2008.
5.	Khurmi .R.S, "*Strength Of Material*", 23rd edition, S. Chand Limited, 2007, New Delhi.
6.	Beer and Johnson, "*Mechanics for Engineers, Statics and Dynamics*", Mc Graw Hill Book Company, 1987.
7.	Fred B. Seely, James Ohrea Smith, "*Advanced Mechanics of Materials*", Wiley, 1955.
8.	Bansal.R. K, "*Strength of Materials*", Revised Edition 4, Laxmi Publications (P) Limited,

	New Delhi, 2010.						
9.	Dongre, A.P., "*Strength of Material*", Scitech publication India. 2nd Edition, August, 2014						

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE204		STRUCTURAL DESIGN (MASONRY AND RCC)	L	T	P	C
			2	2	0	3
Co-requisite:	NIL					
Prerequisite:	15CE203					
Data Book / Codes/Standards	IS : 456-2000, IS : 10262-2009, IS : 1905-1987, SP – 16 Design Charts					
Course Category	P	PROFESSIONAL CORE	STRUCTURAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To impart comprehensive knowledge on the design of masonry and reinforced concrete structures.			
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able to				
1.	Design masonry structures like walls, columns, and foundation incorporating earthquake resistant features	a	c	e
2.	Bring about an understanding of the behaviour of reinforced concrete , the design philosophies mix design	a	c	e
3.	Design RCC beams and slabs, columns and footings including structural design of piles and pile caps	a	c	e
4.	Design RCC columns and footings including structural design of piles and pile caps	a	c	e
5.	Design RCC footings including structural design of piles and pile caps	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I- MASONRY	**10**			
1.	Introduction to Strength of bricks and brick masonry	1	C	1	6,7
2.	Structural design of walls using BIS Codes and use of nomograms	3	C,D	1	6,7
3.	Design of Masonry piers and columns	2	C,D	1	6,7
4.	Design of footings for walls and columns	2	C,D	1	6,7
5.	Earthquake resistant features in masonry buildings as per BIS codes - Masonry retaining walls	2	C,D	1	6,7
	UNIT II- MIX DESIGN AND BEHAVIOUR OF RCC SECTIONS	**12**			
6.	Introduction to various Grades of Concrete and the concrete mix design of nominal mix and design mix as per BIS codes	3	C,D, I	2	8
7.	Theories of basic design concepts, working stress method, limit state method of design, behavior of RCC beams / slabs in flexure and shear, general codal recommendations for limit state method	2	C,D	2,3	1,2,4,5,6
8.	Limit state method of design of one-way slabs	3	C,D	2,3	1,2,4,5,6
9.	Limit state method of design of two-way slabs	2	C,D	2,3	1,2,4,5,6
10.	Limit state method of design continuous slabs and reinforcement detailing	2	C,D	2,3	1,2,4,5,6
	UNIT III: LIMIT STATE METHOD OF DESIGN OF BEAMS AND STAIRCASES	**15**			
11.	Concept of Transfer of load from slab to beam	1	C,D	2,3	2,5
12.	Limit state method of design of singly reinforced beams	3	C,D	2,3	1-5
13.	Limit state method of design of doubly reinforced beams	4	C,D	2,3	1-5
14.	Limit state method of design of Flanged beams	3	C,D	2,3	1-5
15.	Design of Staircases and use of SP34 for	4	C,D,	2,3	2,5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	reinforcement detailing		I		
	UNIT IV: LIMIT STATE METHOD OF DESIGN FOR COLUMNS	**8**			
16.	Limit state method of design of short and long columns, effective length of columns, braced and unbraced columns	1	C,D	2,3,4	1-5
17.	Design of Axially loaded short columns	1	C,D	2,3,4	1-5
18.	Uni-axial and biaxial bending of columns using interaction curve (SP16), shear in columns	3	C,D	2,3,4	1-5
19.	Design of Long Columns	2	C,D	2,3,4	1-5
20.	Ductile detaining of columns, reinforcement detailing at beam-column joints using SP34, extension of design of columns to piles	1	C,D, I	2,3,4	1-5
	UNIT V: LIMIT STATE METHOD OF DESIGN FOR FOUNDATIONS	**15**			
21.	Limit state method of design of isolated foundations axially loaded	3	C,D	4,5	1-5
22.	Limit state method of design of isolated foundations eccentrically loaded	2	C,D	4,5	1-5
23.	Transfer of forces at column - foundation junction	1	C,D	4,5	1-5
24.	Limit state method of design of combined foundations	4	C,D	4,5	2,5
25.	Pile foundation, pile caps (2/4 piles) and reinforcement detailing	5	C,D, I	4,5	2,5
	Total contact hours	**60**			

Sl.No.	
LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Varghese.P.C, "*Limit State Design Of Reinforced Concrete",* 2nd Ed,PHI Learning Pvt. Ltd., 2004.
2.	Unnikrishna Pillai.S and Deavadas Menon, "*Reinforced Concrete Design,*" Tata MacGraw Hill Publishing Company Limited, Second Edition, New Delhi, 2003.
3.	Krishnaraju .R, Pranesh .R.N, "*Design of Reinforced concrete IS : 456-2000*", New age International Publication (P) Ltd., New Delhi, 2003.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Gambhir.M.L, "*Design of Reinforced Concrete Structures*", Prentice Hall of India, Pvt. Ltd., New Delhi, 2008.
5.	Subramanian.N, "*Design of Reinforced Concrete Structures*", Oxford University Press, New Delhi, 2013.
6.	Anand .S and Arya, "*Masonry and Timber Structures Including Earthquake Resistant Design*", Nem Chand and Brothers, Roorkee, 1987.
7.	Dayaratnam.P, "*Brick & Brick Reinforced Structures*", Oxford & IBH Publications Company Pvt. Ltd.,
8.	Shetty.M.S, "*Concrete Technology*", S.Chand & Co. Ltd., New Delhi, 1986.
9.	IS4326:1976, "*Code of practice for Earthquake Resistant Design and Construction*"of *Buildings*, BIS, New Delhi.
10.	IS13920:1993, "*Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice*"-, BIS, New Delhi.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE206L		CONCRETE AND HIGHWAY LABORATORY		L	T	P	C
				0	0	4	2

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To understand and perform various tests on concrete making materials like cement, aggregates, on fresh and hardened concrete, bricks and also on bitumen as well.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able		
1.	To do tests on cement as per IS codes of practice	a, b & k
2.	To do tests on fine and coarse aggregates according to IS codes of Practice	a, b & k
3.	To do tests on fresh and hardened cement / concrete and brick as per IS codes of practice	a, b & k
4.	To conduct various tests on bitumen and its grades as per IS codes	a, b & k

Sl. No.	**Description of experiments**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I - TESTS ON CEMENT	**12**			
1.	Determination of specific gravity of cement	2	C & O	1	1 &2
2.	Determination of fineness and specific surface area of cement	4	C & O	1	1 & 3
3.	Determination of normal consistency, initial and final setting time of cement	4	C & O	1	1 & 4
4.	Determination of soundness of cement sample (Demonstration only using Le-chatelier apparatus)	2	C	1	1 & 5
	UNIT II - TESTS ON FINE AGGREGATE	**4**			
5.	Determination of specific gravity of fine aggregate	2	C & O	2	1 & 6
6.	Determination of bulking of sand	2	C & O	2	1 & 6
	UNIT III - TESTS ON COARSE AGGREGATE	**20**			
7.	Determination of specific gravity of coarse aggregate (Pycnometer and wire basket method)	4	C & O	2	1 & 6
8.	Determination of fineness modulus of coarse aggregate using sieve analysis	4	C & O	2	1 & 7
9.	Determination of Flakiness index and elongation index of coarse aggregate	4	C & O	2	1 & 7
10.	Determination of crushing and impact strength of coarse aggregates	4	C & O	2	1, 8 & 9
11.	Determination of abrasion resistance of coarse aggregate.	4	C & O	2	1 & 8
	UNIT IV - TESTS ON FRESH CONCRETE	**4**			
12.	Determination of the degree of workability of fresh concrete using slump cone test.	2	C & O	3	1 & 10
13.	Determination of the degree of workability of fresh concrete using compaction factor	2	C & O	3	1 & 10

Sl. No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
	test.				
	UNIT V - TESTS ON HARDENED CONCRETE / BRICKS	**8**			
14. .	Determination of compressive strength of cement, cement mortar, concrete and bricks	4	C & O	3	1, 11, 12 & 13
15.	Determination of split tensile strength of concrete cylinders	2	C & O	3	1 & 14
16.	Determination of modulus of rupture of concrete standard beams	2	C & O	3	1 & 12
	UNIT VI - TESTS ON BITUMEN	**12**			
17.	Determination of penetration resistance of bitumen	3	C & O	4	1 & 17
18.	Determination of softening point of bitumen	3	C & O	4	1 & 18
19.	Determination of ductility property of bitumen	2	C & O	4	1 & 19
20.	Determination of viscosity of bitumen	2	C & O	4	1 & 20
21.	Mix design of bituminous mix (Demo only)	2	C	4	
	Total contact hours		**60**		

LEARNING RESOURCES	
Sl.No.	**REFERENCES**
1.	Laboratory Manual
2.	IS 4031-11 (1988): Methods of physical tests for hydraulic cement, Part 11: Determination of density
3.	IS 4031-2 (1999): Methods of physical tests for hydraulic cement, Part 2: Determination of fineness by specific surface by Blaine air permeability method
4.	IS 4031-5 (1988): Methods of physical tests for hydraulic cement, Part 5: Determination of initial and final setting times.
5.	IS 4031-3 (1988): Methods of physical tests for hydraulic cement, Part 3: Determination of soundness
6.	IS 2386-3 (1963): Methods of test for aggregates for concrete, Part 3: Specific gravity, density, voids, absorption and bulking.
7.	IS 2386-1 (1963): Methods of Test for Aggregates for Concrete, Part I: Particle Size and Shape
8.	IS 2386-4 (1963): Methods of test for aggregates for concrete, Part 4: Mechanical properties
9.	IS 5640 (1970): Method of test for determining aggregate impact value of soft coarse aggregates
10.	IS 1199 (1959): Methods of sampling and analysis of concrete
11.	IS 4031-6 (1988): Methods of physical tests for hydraulic cement, Part 6: Determination of compressive strength of hydraulic cement.
12.	IS 516 (1959): Method of Tests for Strength of Concrete
13.	IS 3495-1 to 4 (1992): Methods of tests of burnt clay building bricks: Part 1 Determination of compressivestrength
14.	IS 5816 (1999): Method of Test Splitting Tensile Strength of Concrete
15.	IS 13311-2 (1992): Method of non-destructive testing of concrete-methods of test, Part 2: Rebound hammer
16.	IS 13311-1 (1992): Method of Non-destructive testing of concrete, Part 1: Ultrasonic pulse velocity
17.	IS 1203 (1978): Methods for Testing Tar and Bituminous Materials – Determination of penetration
18.	IS 1205 (1978): Methods for Testing Tar and Bituminous Materials – Determination of softening point
19.	IS 1208 (1978): Methods for Testing Tar and Bituminous Materials – Determination of ductility
20.	IS 1206 part 1 (1978): Methods for Testing Tar and Bituminous Materials – Determination of

viscosity				

Course nature			PRACTICAL		
Assessment Method					
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination
	Weightage	**40%**	**5%**	**5%**	**10%**
End semester examination Weightage : 40%					

		L	**T**	**P**	**C**
15CE208	**APPLIED HYDRAULIC ENGINEERING**	**3**	**0**	**0**	**3**

Co-requisite:	NIL
Prerequisite:	15CE205
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE WATER RESOURCES ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**					
At the end of the course, student will be able							
1.	To study the measurement of pressure of fluid in pipes using various devices like manometers, mechanical gauges	a	b		e	k	
2.	To study the measurement of velocity and discharge using weirs, notches, venturimeter etc.,	a	b	c	e	k	
3.	To study open channel flow through Chezy's, Manning's, Kutter's formulae; economical channel sections, hydraulic jump; introduction to irregular flows.	a	b	c	e	k	
4.	To understand the components , function, and uses of centrifugal and reciprocating pumps.	a	b	c	e	k	
5.	To understand the components , function, and uses of Pelton wheel, Kaplan and Francis turbines	a	b	c	e	k	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: PRESSURE MEASUREMENT	**7**			
1.	Introduction -brief recap of fluid mechanics & overview of subject	1		1-5	1,2
2.	Introduction – pressure and pressure head, Pascals' law, applications	1	C	1	1,2
3.	Atmospheric, Absolute, Gauge and Vacuum pressure	1	C,I	1	1,2,3,4
4.	Measurement, Manometers, Simple manometers, Differential manometers, Advantages and limitations of manometers gaues,	2	C,I	1	1,2,5
5.	Mechanical gauges, Bourdan tube gauge	2	C, I	1	2,3
	UNIT II: FLOW MEASUREMENT	**10**			
6.	Velocity, Pitot tube, Current meter, Floats	2	C,I	2	2,3,5
7.	Discharge, Venturimeter, Orificemeter, Rotameter	2	C,I	2	1,2
8.	Notches/ Weirs, Rectangular, Triangular, Trapezoidal, Stepped	3	C,I	2	2,3,4
9.	Effect on discharge due to error in head measurement	1	C,I	2	3,4,5
10.	Broad crested, Narrow crested and Ogee weir	2	C,I	2	1,2
	UNIT III: OPEN CHANNEL FLOW	**10**			
11.	Open channel, Types of flow, Uniform flow, Chezy's formula, Manning's formula and Kutter's formula	2	C	3	3,4
12.	Most economical section, Rectangular and Trapezoidal section	2	C,D	3	3,4
13.	Non Uniform flow, Specific energy and Specific	3	C,I	3	3,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	energy curves				
14.	Hydraulic Jump, Measurement of flow in irregular channels	3	C,I	3	1,2
	UNIT IV: PUMPS	**9**			
15.	Classification, Centrifugal pump, Component and working	1	C	4	2,3,5
16.	Velocity triangle, work done, losses and efficiencies, specific speed	2	C,I	4	3,4,5
17.	Multistage centrifugal pump, Characteristic curves, Net positive suction head	2	C,I	4	1,2
18.	Reciprocating pump, Component and working	1	C	4	1,2,3
19.	Discharge, Work done, Coefficient of discharge, Slip, Indicator diagram, Effect of acceleration and friction	2	C,I	4	1,2,3,4
20.	Maximum speed of reciprocating pump, Air vessel and its functions	1	C	4	3,4,5
	UNIT V: TURBINES	**9**			
21.	Components of Hydro Electric Power Plant, Classification of Turbine	1	C,I	5	1,2,3
22.	Pelton wheel, Kaplan turbine, Francis turbine construction and working	3	C,D,I	4	2,3,5
23.	Velocity Triangles, Workdone, Design aspects.	2	C,D,I	4	3,4,5
24.	Draft tube theory, Specific speed, Cavitation , Selection of turbines	3	C,D,I	4	3,4,5
	Total contact hours	**45**			

LEARNING RESOURCES

Sl.No.	TEXT BOOKS
1.	Modi, P.N and Seth S.M " *Hydraulics and fluid mechanics*". Standard book house, 2005.
2.	Rajput R.K, " *Fluid mechanics and Hydraulic machines*", S. Chand and company Ltd., 2005.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Bansal, R.K, " *Fluid mechanics and hydraulic machines*", Laxmi publications, 2005
4.	Subramanya, K., " *Theory and applications of fluid mechanics* ", tata McGraw Hill Publishing Company, 2002.
5.	http://nptel.ac.in/courses/105103021/

Course nature	Theory

Assessment Method (Weightage 100%)

In-semester	Assessment tool	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	Total
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE210		GEOMATICS SURVEYING	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE207
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE GEOMATICS ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To learn the different aspects of Geomatics surveying and the advancement in the different types of Surveying. The course will enable the engineers to the new frontiers of science like Hydrographic surveying, EDM, Global Positioning System and Photogrammetry and Remote Sensing.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES			
At the end of the course, student will be able					
1.	To know the basics, importance, and methods of Triangulation and Trilateration.	a	b	e	k
2.	To study the various Hydrographic Surveying Techniques.	a	b	e	k
3.	To study the Advance Surveying Instruments like EDM Total Station and GPS.	a	b	e	k
4.	To Study the Concept of Aerial Photo Interpretation.	a	b	e	k
5.	To learn the importance and different aspects of remote sensing.	a	b	e	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I:TRIANGULATION AND TRILATERATION	**9**			
1.	Horizontal and vertical control - methods	1	C	1	1, 2, 3, 4
2.	Triangulation – Network, Signals.	2	C	1	1, 2, 3, 4
3.	Base line - choices - instruments and accessories -	1	C	1	1, 2, 3, 4
4.	extension of base lines - corrections	2	C	1	1, 2, 3, 4
5.	Satellite station - reduction to centre - Intervisibility of height and distances -.	1	I	1	1, 2, 3, 4
6.	Axis single corrections	2	C	1	1, 2, 3, 4
	UNIT II: HYDROGRAPHIC SURVEYING	**9**			
7.	Shore line survey, Tides - Gauges, Signals,	1	C	2	4, 10
8.	Sounding , Equipments - Sounding Rods and Lead Lines, ,	1	C	2	4, 10
9.	Sounding Chain and lead, Sounding Machine, Fathometers, Sextants	1	C	2	4, 10
10.	Locating the sounding - Transit and stadia, Range and time intervals,	1	C, I	2	4, 10
11.	Range and one angle from shore, Range and one angle from Boat, Two angle from Boat, Intersecting Ranges, Cross ropeShore,	1	C, I	2	4, 10
12.	Plotting of sounding - The Three point problem- Mechanical, Graphical Analytical methods.	1	C, I	2	4, 10
13.	River survey	3	C	2	4, 10
	UNIT III : EDM, TOTAL STATION, GPS SURVEYING	**9**			
14.	Electro-optical system-Measuring Principle, Working Principle,	1	C	3	3, 7, 10
15.	Microwave system-Measuring and working principle - Sources of error	2	C	3	3, 7, 10
16.	Total station-Measuring and working principle, Sources of error	1	C, I	3	3, 7, 10

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
17.	Coordinate system, GPS - Fundamentals	1	C,D	3	3, 7, 8, 10
18.	Introduction space, Control segments User segment	2	C,D	3	3, 7, 8, 10
19.	Errors in GPS signal propagation	1	C,D	3	3, 7, 8, 10
20.	GPS Survey types - Kinematic and static	1	D,I	3	3, 7, 8, 10
	UNIT IV:PHOTOGRAMMETRY SURVEYING	**9**			
21.	Introduction , Photo theodolite, Terrestrial and Aerial photographs - vertical and oblique photographs	2	C	4	5, 6
22.	Flight Planning,	2	C	4	5, 6
23.	Scale of an aerial photograph-Measurement of Scale.	1	D,I	4	5, 6
24.	stereoscopy principles - parallax, Height determination by Parallax bar	2	D,I	4	5, 6
25.	Photo Interpretation, Applications of aerial Photos.	2	D,I	4	5, 6
	UNIT V: REMOTE SENSING	**9**	D,I	4	5, 6
26.	Introduction – Historical Background - Electromagnetic Radiation (EMR)	1	D,I	5	5, 8, 9
27.	Electromagnetic Spectrum, Interactions with atmosphere and Earth features	2	C	5	5, 8, 9
28.	Platform, Sensors - Definition, Types Airborne Platforms	1	C	5	5, 8, 9
29.	Geostationary and Sunsynchronuous Orbits,	2	C	5	5, 8, 9
30.	Parameter of Remote Sensing-Spatial-Spectral-Radiometric-Temporal	1	C	5	5, 8, 9
31.	Microwave remote sensing Scanners - Radiometer - RADAR	2	C	5	5, 8, 9
Total contact hours		**45**			

Sl.No.	TEXT BOOKS
	LEARNING RESOURCES
	TEXT BOOKS
1.	Kanetkar .T.P, "*Surveying and Levelling*" Vols. I and II, United Book Corporation, Pune, 1994.
2.	*Surveying and leveling Part I"I*, Late T P Kanetkar and Prof. S V Kulkarni, Poona VidyagrihaPrakashan,
3.	Punmia .B.C, "*Surveying*, Vols". I and II, Laxmi Publications,1999.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Chandra .A.M "*Plane Surveying and Higher Surveying*", New Age International (P) Limited, Publishers, Chennai, 2002.
5.	Agarwal .C.S, Garg .P.K, "*Remote Sensing*", Wheekrs Publishing Co., 2000.
6.	Wolf, P.R "*Elements of Photogrammetry*", Tata MaGrawHill Co., 1997.
7.	Burnside .C.D, "*Electromagnetic Distance Measurement*," Beekman Publishers, 1971.
8.	Anji Reddy .M, "*Remote sensing and Geographical information system*," B.S Publications,
9.	Leudr.D.R., "*Aerial Photographic Interpretation*," McGrawHill, 1959.
10.	Arora .K.P, "*Surveying* ", Volume III, Standard Book House, 2000.

Course nature				Theory		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :						**50%**

15CE210L	GEOMATICS SURVEYING LABORATORY AND SURVEY CAMP	L	T	P	C
		0	0	4	2
Co-requisite:	NIL				
Prerequisite:	15CE207L				
Data Book / Codes/Standards	Survey Laboratory Manual				
Course Category	P PROFESSIONAL CORE GEOMATICS ENGINEERING				
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	To measure the elevation of points by advanced methods and instruments.				
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**			
At the end of the course, student will be able					
1.	To conduct experiments related to finding height and distances by tachometric surveying.	a	b	g	j
2.	To conduct setting out of simple curve for construction of road purposes.	a	b	g	j
3.	To study the co-ordinate measurements by GPS and traversing by Total station.	a	b	g	j
4.	To study about the use of stereoscope for 3-D viewing,	a	b	g	j

Sl. No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Tacheometric Surveying--Constants of Tacheometer	3	I-O	1	1
2.	Tacheometric Surveying--Stadia Tacheometry	3	I-O	1	1
3.	Tacheometric Surveying--Tangential Tacheometry	3	I-O	1	1
4.	Tacheometric Surveying--Subtense bar method	3	I-O	1	1
5.	Contouring	6	I-O	1	1
6.	Setting out simple circular curve --Single Theodolite Method	6	I-O	2	1
7.	Setting out simple circular curve --Double Theodolite Method	6	I-O	2	1
8.	GPS Surveying –Measurement of Coordinates	3	I-O	3	1
9.	Total Station Surveying - Measurements of Distances and angles,	6	I-O	3	1
10.	Total Station Surveying- Measurements of, Slope	6	I-O	3	1
11.	Total Station Surveying- Measurements of distances &Height	6	I-O	3	1
12.	Total Station Surveying - Measurements of , Traversing,	3	I-O	3	1
13.	Use of Stereoscope for 3-D Viewing	3	I-O	4	1
14.	Height determination from a Stereo pair using the Parallax bar	3	I-O	4	1
	Total contact hours	**60**			

LEARNING RESOURCES	
Sl. No.	**REFERENCES**
1.	Geomatics surveying lab manual

SURVEY CAMP (1 WEEK)

PURPOSE
Experiments in the various types of surveying in actual field to provide better knowledge and develop skills of application in real life situations
INSTRUCTIONAL OBJECTIVES
Depending upon the field, various methods of chaining, traversing, leveling, GPS and total station can be adopted to get wide experience in the camp.

LIST OF EXPERIMENTS
1. Triangulation 2. Total Station 3.Contouring 4. GPS 5. Road survey (LS and CS)

Course nature					Practical		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Experiments**	**Record**	**MCQ/Quiz/Viva Voce**	**Model examination**	**Survey camp**	**Total**
	Weightage	**40%**	**5%**	**5%**	**5%**	**5%**	**60%**
End semester examination Weightage :							**40%**

15CE301	STRUCTURAL ANALYSIS	L	T	P	C
		2	2	0	3

Co-requisite:	NIL		
Prerequisite:	15CE203		
Data Book / Codes/Standards	NIL		
Course Category	P	PROFESSIONAL CORE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	To enable student to solve statically indeterminate structures		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Identify indeterminate structures and determine the degree of indeterminacy	a	c
2.	Apply Macaulay's method and Clapeyron's theorem to solve indeterminate beam problems	a	c
3.	Apply energy principles to beams, frames and trusses	a	c
4.	Apply matrix flexibility method to solve beams and frames	a	c
5.	Apply slope deflection and moment distribution methods to solve beams and frames	a	c

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: PROPPED CANTILEVER, FIXED AND CONTINUOUS BEAMS	**12**	-	-	1,2,6,7
1.	Introduction to statically indeterminate structures – degree of static indeterminacy of beams and frames	2	C	1	1,2,6,7
2.	Application of Macaulay's method to analyze propped cantilevers	1	I	2	1,2,6,7
3.	Application of Macaulay's method to analyze fixed beams	2	I	2	1,2,6,7
4.	Analysis of continuous beams using Clapeyron's theorem of three moments	4	C, I	2	1,2,6,7
5.	Analysis of continuous beams with differential settlements using Clapeyron's theorem of three moments	3	I	2	1,2,6,7
	UNIT II ENERGY METHODS FOR ANALYZING BEAMS, FRAMES AND TRUSSES	**12**			
6.	Use of Castigliano's theorem to analyze propped cantilever and fixed beams	2	I	3	1,2,4,5,8,9
7.	Analysis of non-sway frames up to a degree of indeterminacy of two using Castigliano's theorem	2	I	3	1,2,4,5,8,9
8.	Analysis of sway frames up to a degree of indeterminacy three using Castigliano's theorem	3	I	3	1,2,4,5,8,9
9.	Introduction to Unit load method	1	C	3	1,2,4,5,8,9
10.	Analysis of indeterminate trusses up to a degree of indeterminacy of two using unit load method	2	I	3	1,2,4,5,8,9
11.	Analysis of indeterminate trusses for lack of fit	1	I	3	1,2,4,5,8,9
12.	Analysis of indeterminate trusses for temperature stresses	1	I	3	1,2,4,5,8,9
	UNIT III: MATRIX FLEXIBILITY METHOD OF ANALYSIS OF INDETERMINATE	**11**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	STRUCTURES				
13.	Concept of flexibility of structures	**1**	C	4	1,3
14.	Derivation of direct flexibility matrix equation	1	C, I	4	1,3
15.	Application of flexibility matrix method to solve propped cantilever	1	I	4	1,3
16.	Application of flexibility matrix method to solve fixed beam	1	I	4	1,3
17.	Application of flexibility matrix method to solve non-sway frames up to a degree of indeterminacy of two.	3	I	4	1,3
18.	Application of flexibility matrix method to solve sway frames up to a degree of indeterminacy of three.	4	I	4	1,3
	UNIT IV: SLOPE DEFLECTION METHOD	**12**			
19.	Degree of kinematic indeterminacy and degrees of freedom of beams , frames and trusses	1	C	5	1,2,6,7
20.	Introduction and derivation of slope deflection equations	1			
21.	Application of slope deflection method to solve continuous beams up to a degree of indeterminacy of three	4	I	5	1,2,6,7
22.	Application of slope deflection method to solve continuous beams with settlements	1	I	5	1,2,6,7
23.	Application of slope deflection method to solve non sway frames	2	I	5	1,2,6,7
24.	Application of slope deflection method to solve sway frames	3	I	5	1,2,6,7
	UNIT V: MOMENT DISTRIBUTION METHOD	**13**			1,2,6,7
25.	Introduction and development of moment distribution method	1	C	5	1,2,6,7
26.	Application of moment distribution method to solve continuous beams up to a degree of in determinacy of three	2	I	5	1,2,6,7
27.	Application of moment distribution method to solve continuous beams with settlements	2	I	5	1,2,6,7
28.	Application of moment distribution method to solve non sway frames	3	I	5	1,2,6,7
29.	Application of moment distribution method to solve sway frames	3	I	5	1,2,6,7
30.	Introduction to Kani's method –and advantages of Kani's method over moment distribution method- Application of Kani's method to sway frames (single bay, single storey)	2	C, I	5	1,2,6,7
	Total contact hours			**60**	

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Menon.D, "*Structural Analysis*",*Alpha Science* International Limited, 2009.
2.	*Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Theory of Structures", Laxmi Publications, New Delhi, 12th Edition, 2004.*
3.	Pandit.G.S., Gupta.S.P., "*Structural Analysis- A Matrix Approach*", 2nd Edition, Tata McGraw-Hill Education, New Delhi,2010.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Bhavikatti.S.S., "*Structural Analysis Vol-1*", E-3, Vikas Publishing House Pvt Limited, 2009.

5.	Vaidyanathan.R, **"*Comprehensive Structural Analysis", Volume 1*,** Laxmi Publications, New Delhi, 2005.
6.	Wang .C.K, *"Statically Indeterminate Structures",* McGraw Hill International Book Company, 1984.
7.	Harry H.West., *"Analysis of Structures"*, John Wiley &Sons.1980.
8.	Charles Head Norris, John Benson Wilbur, Senol Utku, *"Elementary Structural Analysis"*, 3rd Edn. McGraw Hill International Editions, Structures Series, 1987.
9.	Timoshenko.S.P & Young .D.H, *"Theory of Structures"*, 2 Edn. McGraw Hill Book Company, International Ed. 1965.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE303		STRUCTURAL DESIGN - STEEL		L	T	P	C
				2	2	0	3
Co-requisite:	Nil						
Prerequisite:	15CE203						
Data Book / Codes/Standards	IS : 800-2007, Steel Tables(Revised), IS : 801 & IS : 811						
Course Category	P	PROFESSIONAL CORE	STRUCTURAL ENGINEERING				
Course designed by	Department of Civil Engineering						
Approval	32nd Academic Council Meeting , 2016						

PURPOSE	To develop knowledge in designing structural elements made of steel			
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able to				
1.	Understand basics of limit state design, code provisions and to design tension members	a	c	e
2.	Design connections	a	c	e
3.	Design steel members subjected to compression	a	c	e
4.	Design simple and built-up beams	a	c	e
5.	Design light gauge steel sections	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I-INTRODUCTION AND TENSION MEMBERS	**12**			
1.	Types of Steel Structures - Properties of Structural Steel, Indian Standard Specifications and sections	1	C,D	1	1-9
2.	Design criteria as per IS800:2007	1	C,D	1	1-2
3.	Analysis methods- Calculation of Loads as per IS codes	1	C,I	1	1-10
4.	Design Philosophy-Introduction to Limit State Method of design – Partial safety factor- general design requirements as per IS800:2007	1	C,D	1	1-2
5.	Design provisions **of** Tension members	1	C,D	1	1-9
6.	Design of simple tension members -Effective net area-Types of failures	1	C,D,I	1	1-9
7.	Design of Plates with holes subjected to tension	2	C,D,I	1	1-9
8.	Design of Angles subjected to tension	2	C,D,I	1	1-9
9.	Design of built-up members - Tension splices	2	C,D,I	1	1-9
	UNIT II-CONNECTIONS	**10**			
10.	Types of Connections-Bolted and Welded connections - types of bolts and welds	2	C	2	1-9
11.	Load transfer mechanism- failure of joints - permissible stresses	2	C,D	2	1-9
12.	Design of Pin connections-Design of lap joints	2	C,D,I	2	1-9
13.	Design of butt joints	2	C,D,I	2	1-9
14.	Design of Truss joint	2	C,D,I	2	1-9
	UNIT III-COMPRESSION MEMBERS	**14**			
15.	Compression member design -Design provisions	1	C,D	3	1-9
16.	Effective length-Slenderness ratio-Types of buckling-Classification of cross-sections	2	C,D	3	1-9
17.	Design of simple columns	3	C,D,I	3	1-9
18.	Design of built up columns -Types	2	C,D,I	3	1-9
19.	Design of lacing	3	C,D,I	3	1-9
20.	Design of batten	3	C,D,I	3	1-9
	UNIT IV-BEAMS	**14**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
21.	Behavior of Steel members in flexure	2	C	4	1-9
22.	Design of simple beams	2	C,D,I	4	1-9
23.	Phenomenon of Web Buckling and Web Crippling-Design provisions	2	C,D,I	4	1-9
24.	Lateral Torsional Buckling behavior of unrestrained beams	3	C,D,I	4	1-9
25.	Check for Lateral Torsional Buckling of unrestrained beams	1	C,D,I	4	1-9
26.	Design of beams subjected to Biaxial Bending	2	C,D,I	4	1-9
27.	Design of built-up beams	2	C,D,I	4	1-9
	UNIT V- LIGHT GAUGE STEEL SECTIONS	**10**			
28.	Design of light gauge steel members-design provisions	1	C,D	5	4,5,6
29.	Local and post buckling behavior of thin element of light gauge steel sections	1	C,D	5	4,5,6
30.	Design of light gauge steel compression members	3	C,D,I	5	4,5,6
31.	Design of light gauge steel tension members	2	C,D,I	5	4,5,6
32.	Design of light gauge steel beams	2	C,D,I	5	4,5,6
33.	Design of connections	1	C,D,I	5	4,5,6
	Total contact hours			**60**	

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Subramanian.N, "*Design of Steel Structures-Limit State Method*", Oxford University Press, New Delhi, 2016
2.	Duggal .S.K, "*Limit State Design of Steel Structures*", Tata McGraw Hill Publishing Company, New Delhi, 2010.
3.	**REFERENCE BOOKS/OTHER READING MATERIAL**
4.	Gaylord,E.H.,Gaylord,N.C., and Stallmeyer,J.E., "*Design of Steel Structures*", McGraw Hill Pub.,1992.
5.	Ramamrutham .S., "*Design of Steel Structures*", Dhanpat Rai Pub., 2013.
6.	Vazirani .V.N, "Design and Analysis of *Steel Structures*", Khanna Publishes, 2003.
7.	Ramachandra .S, Virendra Ghelot, "*Limit State Design of Steel of Structures*", Scientific Publishers, New Delhi,2012.
8.	Arya.A.S. & Ajmani.J.L., "*Design of Steel Structures*", Nemchand & Bros., 2011.
9.	Dayarathnam .P, "*Design of Steel Structures*", S.Chand and Company Ltd. , 2008.
10.	Kazimi. S. M. A. and Jindal. R. S., "*Design of Steel Structures*", 2nd Edition, Prentice Hall of India,1988.
11.	IS: 875(Parts 1,2,3): "*Code of Practice for Design Loads on Buildings and Structures*", BIS, New Delhi, 1987 (Reaffirmed 2003)

Course nature				Theory		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE305L	HYDRAULIC ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

Co-requisite:	15CE208
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE WATER RESOURCES ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES		
At the end of the course, student will be able				
1.	To learn the working principle, components, functions of orificemeter and venturimeter.	a	b	k
2.	To determine the losses in pipes.	a	b	k
3.	To study the flow through orifices, mouthpieces and notches.	a	b	k
4.	To study the concept of Buoyancy	a	b	k
5.	To study the performance of centrifugal and reciprocating pumps.	a	b	k
6.	To study the performance of Pelton wheel and Francis turbines.	a	b	k

Session	Description of Experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Measurement of Flow using Venturimeter	4	O	1	1,2,3
2.	Measurement of Flow using Orificemeter	4	O	1	1,2,3
3.	Determination of Friction Factor of the Pipe Material	4	O	2	1,2,3
4.	Losses due to Sudden Contraction and Sudden Enlargement of the Pipe	4	O	2	1,2,3
5.	Measurement of Flow through Orifice	5	O	3	1,2,3
6.	Measurement of Flow thorough Mouthpiece	5	O	3	1,2,3
7.	Measurement of Flow through Notch	5	O	3	1,2,3
8.	Determination of Metacentric Height	5	O	4	1,2,3
9.	Performance Test on Centrifugal Pump	6	O	5	1,2,3
10.	Performance Test on Reciprocating Pump	6	O	5	1,2,3
11.	Performance Test on Pelton Wheel	6	O	6	1,2,3
12.	Performance Test on Francis Turbine	6	O	6	1,2,3
Total Contact Hours		**60**			

LEARNING RESOURCES	
Sl.No.	**REFERENCE**
1.	Laboratory Manual
2.	Rajput .R.K, *"Fluid Mechanics and Hydraulic Machines"*, S.Chand and Company Ltd., 2013.
3.	Bansal .R.K, *"Fluid Mechanics and Hydraulic Machines"*, Laxmi Publications 2010

Assessment Method					
In-semester	**Assessment tool**	Conducting experiments and submission of records	Objective type tests on the experiments carried out	Written Quiz on experiments	Model examination
	Weightage	**40%**	**10%**	**--**	**10%**
End semester examination Weightage : 40%					

	15CE309	GEOTECHNICAL ENGINEERING I	L	T	P	C
			2	2	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE GEOTECHNICAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	This course is aimed to develop analytical skills in dealing with soil as a medium of water flow, a medium for structural supports and a primary building material.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES			
At the end of the course, student will be able to					
1	Provide the description, classification and to know about properties of soil.	a	e		
2	Familiarize the students an understanding of permeability and seepage of soils	a	e		
3	To know about the consolidation and compaction effect on soil in lab and field.	a	e	k	
4	To develop an understanding of the principles of effective stress in saturated soils, and its application to various soil condition and to know the shear strength of the soils.	a	e	k	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: BASIC CONCEPTS	**12**			
1.	Definition of Soil and Soil Mechanics- Formation of soils	1	C	1	1,2,3
2.	Type of Soils	2	C		
3.	Two and Three phase systems and relationships - problems	4	C,D	1	1,2,3
4.	Specific gravity – Definition - Determination	2	C,D	1	1,2,3
5.	Field density - sand replacement and core cutter method	3	C,D	1	1,2,3
6.	**UNIT II: INDEX PROPERTIES**	**12**			
7.	Classification of soil - Grain size analysis	2	C	1	1,2,3
8.	Stoke's law and Hydrometer analysis	2	C	1	1,2,3
9.	Consistency - Atterberg limits – PI, LI, CI, SR, FI & TI Problems	5	C,D	1	1,2,3
10.	Classification of coarse grained and fine grained soils as per BIS	3	C,I	1	1,2,3
11.	**UNIT III: PERMEABILITY AND SEEPAGE**	**12**			
12.	Permeability – Definition - Assumptions- One dimensional flow through soil - Darcy's law - Limitations	2	C	2	1,2,3
13.	Field and laboratory permeability tests	4	C, I	2	1,2,3
14.	Permeability in stratified soil deposits	3	C,D	2	1,2,3
15.	Factors affecting permeability, Introduction to flow nets – Properties – Applications – Discharge Velocity and seepage Velocity	3	C	2	1,2,3
16.	**UNIT IV: COMPACTION AND CONSOLIDATION**	**12**			
17.	Compaction - Lab compaction methods - Proctor's test	3	C,D, I	3	1,2,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
18.	Field compaction methods - factors affecting compaction – effect of compaction in soil properties	2	C	3	1,2,3,4
19.	California Bearing Ratio test	2	C,D,I	3	1,2,3,4
20.	Consolidation - definition - Terzaghi's theory of one dimensional consolidation partial differential equations(no analytical)	2	C	3	1,2,3,4
21.	Laboratory test - Determination of co-efficient of consolidation- √t and log t methods.	3	C	3	1-6
22.	**UNIT V: STRESS DISTRIBUTION AND SHEAR STRENGTH**	**12**			
23.	Introduction - Stresses in soils - Effective and neutral stresses	2	C	4	1-6
24.	Stress distribution in soil media - Boussinesq and Westergards equation – point load, uniformly distributed load, line load, rectangular load – Pressure bulb – Newmark's chart - Introduction	3	C,D	4	1,2,3
25.	Shear strength - Shear strength of cohesive and cohesionless soils - Mohr - coulomb's theory	2	C	4	1,2,3
26.	Laboratory and field test: Direct, triaxial and unconfined shear strength test – lab and field vane shear test	4	C,D,I	4	1,2,3
27.	Factors affecting shear strength.	1	C	4	1-6
	Total contact hours	**60**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
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	Gopal Ranjan, Rao.A.S.R., *Basic and Applied Soil Mechanics*, Wiley Eastern Ltd., 2000
	REFERENCE BOOKS/OTHER READING MATERIAL
4	Terzaghi K., Peck R.B., *Soil Mechanics in Engineering Practice*, John Wiley Ltd., 1967
5	Lambe T.W., Whitman, *Soil Mechanics*, John Wiley Ltd., 1979.
6	Arora .K.R, "Soil Mechanics and Foundation Engineering", Standard Publication Distributors , 2011.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE309L	GEOTECHNICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

Co-requisite:	15CE309 -Geotechnical Engineering - I
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P	Professional Core	GEOTECHNICAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To provide the hands on training in determination of Engineering and index properties of soils, applied to the field problems.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES
At the end of the course, student will be able to		
1.	Get Familiarized to do the experiments as per the guidelines of BIS	b
2.	Gain the knowledge on the use of experimental results pertaining to foundation problems	b

Sl. No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Water content determination (Oven drying method)	2	O	1	1
2.	Grain size distribution - Sieve analysis	5	O	1	1
3.	Determination of Specific gravity by Pycnometer and density bottle method	5	O	1	1
4.	Determination of Liquid and Plastic limit (Casagrande method)	5	O	1	1
5.	Determination of Shrinkage limit of soil	5	O	1	1
6.	Determination of moisture-density relationship (Standard Proctor's)	5	O	1,2	1
7.	Determination of Permeability by Constant and Variable head method	5	O	1,2	1
8.	Determination of in-situ density by sand replacement and core cutter method	5	O	1,2	1
9.	Determination of Relative density - Sand	5	O	1,2	1
10.	Unconfined compression test for fine grained soils	5	O	1,2	1
11.	California Bearing Ratio (CBR) Test	5	O	1,2	1
12.	Direct shear test	5	O	1,2	1
13.	Triaxial Compression Test (Demo)	3	O	1,2	1
	Total contact hours	60			

LEARNING RESOURCES	
Sl.No.	**REFERENCES**
1.	Laboratory Manual

Course nature				Practical		
Assessment Method (Weightage 100%)						
In-semester	Assessment tool	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	Total
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
					End semester examination Weightage :	**40%**

15CE311		HIGHWAY ENGINEERING	L	T	P	C
			2	2	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE TRANSPORTATION ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	This course is offered to develop skill to design geometric elements and traffic regulatory measures on roads and introduce the student to structural design of pavements

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**				
At the end of the course, student will be able						
1.	To introduce basic highway geometric element and familiarize with its design.	a	b	e	k	
2.	To understand the traffic flow modeling	a	b	e	k	
3.	To impart basic knowledge on the design of various traffic element	a	e	k		
4.	To understand the behavior of flexible pavement to traffic load and to carry out basic design	a	b	e	i	k
5.	To expose the structural component of rigid pavement and its design.	a	e	i	k	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: HIGHWAY GEOMETRIC DESIGN	**13**			
1	Elements of transportation Engineering and Role of transportation in society and Overview of the course	1	-		1,2,5
2	Highway planning and alignment	1	C	1	1, 2
3	Classification of rural and urban roads and its cross sectional elements	1	C	1	1, 2,10
4	Sight Distance – Stopping sight distance, Overtaking sight distance and intersection sight distance	2	C,I	1	1, 2, 10
5	Speed of vehicle on different terrain - Horizontal curve – circular curve radius – super elevation – extra widening - Design of Transition curve – set back distance – reverse curve and compound curve	4	C,D,I	1	1, 2, 10
6	Attainment of super elevation in field	1	C	1	1, 2, 10
7	Design of vertical alignment – summit and valley curve - underpass	2	C,D,I	1	1, 2, 10
8	Introduction to MXROAD software package for geometric design	1	D	1	12
	UNIT II: TRAFFIC FLOW MODELLING	**12**			
9	Fundamental parameters - speed, density, volume, travel time, headway, and spacing - time mean speed, space mean speed and their relation.	2	C	2	3, 4
10	Relation between speeds, flow, density, fundamental diagrams, Greenshield's model, Greenberg's logarithmic model - Moving observer method.	3	C	2	3, 4
11	Car-following models - Concept of stimulus-	3	C	2	3, 4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	response, general motors models - Vehicle arrival models.				
12	Poisson distribution, headway modeling, random vehicle generation - Microscopic traffic simulation – demonstration.	4	C,I,O	2	3, 4
	UNIT III: TRAFFIC FACILITIES DESIGN	**12**			
13	Capacity and Level of service LOS - Definitions, highway capacity, factors affecting LOS - Urban Street - Classification, operational performance measures.	3	C	3	3, 4, 5
14	Traffic signs and road markings – channelization.	2	C	3	3, 5
15	Traffic rotary - design elements, capacity of rotary - Grade separated intersection - Elements of traffic signal - headway, saturation flow.	3	C, D	3	3, 5
16	Design principles of a traffic signal - Phase design, cycle time determination, green splitting - Vehicle actuated signals - Coordinated traffic signal - offset, common cycle length, bandwidth.	4	C, D	3	3, 4
	UNIT IV: INTRODUCTION TO FLEXIBLE PAVEMENT	**12**			
17	Materials - Basic properties of bitumen, Resilient modulus of aggregate and soil	2	C	4	1, 2
18	Cross-section of flexible pavement – specifications for different layers	2	C	4	1, 2
19	Bituminous concrete mix design	2	C,D	4	1, 2
20	Flexible pavement design factor – Traffic factor – equivalent single wheel load , standard axle load, truck factor, vehicle damage factor, number of repetition of standard axle load	3	C,I	4	1, 2, 6, 7
21	Flexible pavement design factor –environmental factor	1	C	4	1, 2, 6, 7
22	Design of flexible pavement – determination of pavement thickness and fatigue damage analysis	2	C,D	4	1, 2, 6, 7
	UNIT V: INTRODUCTION TO RIGID PAVEMENT	**10**			
23	Components of Rigid pavement	1	C	5	1, 2, 6, 8
24	Cement concrete mix design	2	C,D	5	1, 2, 6, 8
25	Design of cement concrete slab	3	C,D	5	1, 2, 6, 8
26	Design of transverse Joints	2	C,D	5	1, 2, 6, 8
27	Design of Longitudinal Joints	2	C,D	5	1, 2, 6, 8
	Total contact hours		**60**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
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
	REFERENCE BOOKS/OTHER READING MATERIAL

7.	Guidelines for the Design of Flexible Pavements, IRC :37- 2012, The Indian Road Congress, New Delhi, 2012
8.	Guidelines for the Design of Rigid Pavements for Highways, IRC:58-2011, The Indian Road Congress, New Delhi
9.	P.H. Wright and K.K. Dixon, Highway Engineering, John Wiley & Sons, Seventh Edition, 2004
10.	AASHTO (2011), A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, Washington, D. C.
11.	http://nptel.ac.in/courses/105101087/ (as on 11.04.2016)
12.	MXROAD- Design manual

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE390L	INDUSTRIAL TRAINING I (Training to be undergone After Year II, Semester II) 2 week practical training in industry	L	T	P	C
		0	0	1	1
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	To provide practical exposure in Civil Engineering related organizations								
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**							
At the end of the training, student will									
1.	Become aware of the practical applications of theoretical concepts studied in the class rooms after undergoing two – week practical training in Civil Engineering related organizations.	d	e	f	g	h	i	j	k

Description of course
Students have to undergo two-week practical training in Civil Engineering related organizations of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.
This course is mandatory and a student has to pass the course to become eligible for the award of degree.

Course nature		PRACTICAL
Assessment Method		
In-semester	**Assessment tool**	
	The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations	
	100%	

15CE302	COMPUTER AIDED STRUCTURAL ANALYSIS	L	T	P	C
		2	2	0	3

Co-requisite:	NIL		
Prerequisite:	15CE301		
Data Book / Codes/Standards	NIL		
Course Category	P	PROFESSIONAL CORE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	To enable students understand the stiffness matrix method amenable for computer programming and also to enable students get an exposure to the analysis of arches, plastic analysis and influence line diagram

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES			
At the end of the course, student will be able to				
1.	Apply matrix method to analyze structures and develop an insight into programming embedded in structural analysis software	a	c	e	k
2.	Analyze arches and suspension cables and bridges	a	c		
3.	Draw influence line diagrams and deal with rolling loads for determinate structures	a	c		
4.	Draw influence line diagrams and deal with rolling loads for indeterminate structures	a	c		
5.	Carry out plastic analysis of structures	a	c		

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: STIFFNESS MATRIX METHOD	**16**			
	Direct Stiffness Method				
1.	Introduction to stiffness and derivation of basic stiffness values and matrix equation	1	C, I	1	2
2.	Application of stiffness method to propped cantilevers and fixed beams	1	I	1	2
3.	Application of stiffness method to continuous beams up to a degree of indeterminacy of three	1	I	1	2
4.	Application of stiffness method to non sway and sway frames	1	I	1	2
5.	Application of stiffness method to sway frames up to a degree of indeterminacy of three	1	I	1	2
	Element Stiffness Method				
6.	Concept of element stiffness matrix for truss members.Global and local coordinates for truss elements	1	C	1	4
7.	Transformation of displacement and force in truss elements. Transformation of truss element stiffness matrix in local coordinates to global coordinates	1	C	1	4
8.	Assembling global stiffness matrix for trusses and formulating matrix equation. (Solution not required)	1	C	1	4
9.	Beam element stiffness matrix	1	I	1	4
10.	Generation of load vector for nodal and distributed loads for beams	1	I	1	4
11.	Assembling structure stiffness matrix and formulating matrix equation for beams. (Solution Not required)	1	I	1	4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
12.	Frame element stiffness matrix and Transformation matrix	2	I	1	4
13.	Assembling global stiffness matrix for two element frame and formulation of matrix equation (solution not required)	2	I	1	4
14.	Introduction to structural analysis software like SAP, ETABS, STAAD.Pro	1	I	1	9,10,11
	UNIT II: THREE HINGED ARCHES AND SUSPENSION BRIDGES	**12**			
15.	Introduction to arches and their behavior under loads.Types of arches- three hinged, two hinged fixed arches	1	C	2	1,3,4
16.	Theoretical arch and Eddy's theorem	1	C	2	3
17.	Analysis of three hinged parabolic arches with supports at same and different levels – BM, SF, Normal thrust, Radial shear and maximum values	2	I	2	3,5,6
18.	Analysis of three hinged circular arches with supports at same levels - BM, SF, Normal thrust, Radial shear and maximum values	1	I	2	3,5,6
19.	Analysis of two hinged parabolic arches with supports at same levels- arches – finding horizontal reaction only.	1	I	2	3,5,6
20.	Introduction to methods of analysis of fixed arches	1	C	2	3,5,6
21.	Introduction to suspension cables and behavior of cable under point loads	1	C	2	3,5,6
22.	Analysis of suspension cables for uniformly distributed loads with pulley and saddle supports at same level and different levels and length of suspension cables	2	I	2	3,5,6
23.	Suspension bridges: Three hinged girder analysis for BM and SF	1	C, I	2	3,5,6
24.	Suspension bridges: Two hinged girder analysis for BM and SF	1	C, I	2	3,5,6
	UNIT III: INFLUENCE LINE DIAGRAMS FOR DETERMINATE STRUCTURES	**11**			3,5,6
25.	Concept of influence lines for BM, SF, Horizontal reaction, Normal thrust, Radial shear	1	C	3	3,5,6
26.	Muller Breslau's principle	1	C	3	3,5,6
27.	Influence lines using Muller Breslau's principle for simply supported beams, overhanging beams and cantilever for BM and SF – Use of software to plot ILD	2	I	3	3,5,6
28.	Finding maximum / absolute maximum BM and SF for simply supported beams due to series of moving loads using influence line diagrams – equivalent uniformly distributed load	3	I	3	3,5,6
29.	Influence line diagrams for determinates truss members, focal length, reversal of stresses	2	I	3	3,5,6
30.	Influence line diagrams for Horizontal thrust, BM, SF in three hinge arches	2	I	3	3,5,6
	UNIT IV: INFLUENCE LINE DIAGRAMS FOR INDETERMINATE STRUCTURES	**9**			
31.	Influence line diagrams for vertical support reactions for two span continuous beams	2	I	4	3,5,6
32.	Influence line diagrams for support moments, and	3	I	4	3,5,6

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	span moments for two span continuous beams				
33.	Influence line diagrams for shear for two span continuous beams	2	I	4	3,5,6
34.	Pattern loading from qualitative Influence line diagrams for multi-span continuous beams	1	I	4	3,5,6
35.	Qualitative influence lines for Horizontal thrust, reactions and moments for portal frames.	1	C	4	3,5,6
	UNIT V: PLASTIC ANALYSIS OF STRUCTURES	**12**			
36.	Introduction to Plastic Analysis -Plastic moment of resistance - Plastic Modulus - Shape factor - Load factor	2	C	5	3,5,6
37.	Shape factor for circular, rectangular, triangular, box and diamond shaped sections	1	I	5	3,5,6
38.	Shape factor for Tee and I section	1	I	5	3,5,6
39.	Method of plastic analysis – mechanism method and equilibrium method – lower bound, upper bound and uniqueness theorems	1	C	5	3,5,6
40.	Plastic hinge- hinge length – simply supported and fixed beam with full UDL /central/ point load	1	C	5	3,5,6
41.	Plastic analysis of indeterminate beams using mechanism method – continuous beams , fixed beams and propped cantilevers	3	I	5	3,5,6
42.	Plastic analysis of indeterminate frames using mechanism method – single bay, single storey rectangular portal frames.	2	I	5	3,5,6
43.	Introduction to pushover analysis	1	C	5	9-11
	Total contact hours		**60**		

	LEARNING RESOURCES
Sl.No.	**TEXT BOOKS**
1.	Menon.D, "*Structural Analysis",Alpha Science* International Limited, 2009.
2.	Pandit.G.S., Gupta.S.P., "*Structural Analysis- A Matrix Approach"*, 2nd Edition, Tata McGraw-Hill Education, New Delhi,2010.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Punmia.B.C, Ashok Kumar Jain, Arun Kumar Jain, "*Theory of Structures"*, Laxmi Publications, New Delhi, 12th Edition, 2004
4.	Hibbeler, R.C., " Structural Analysis (8th edition)", Prentice Hall, New York, 2012
5.	Bhavikatti.S.S, "*Structural Analysis",Vol-2*, E-2, Vikas Publishing House Pvt Limited, 2009.
6.	Vaidyanathan .R, Perumal .P, "*Comprehensive Structural Analysis-Volume II"***,** Laxmi Publications (P) Ltd., New Delhi, 2004.
7.	Natarajan, C., Revathi, P., "Matrix Method Of Structural Analysis Theory and Problems**",** PHI Learning Delhi. 2nd Edition. 2013
8.	Sterling Kinney .J, "*Indeterminate Structural Analysis"*, Narosa Publishing House,1987.
9.	*https://www.bentley.com/en/products/brands/staad*
10.	*https://www.csiamerica.com/products/etabs*
11.	*https://www.csiamerica.com/products/sap2000*

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE302L	COMPUTER AIDED STRUCTURAL ANALYSIS AND TESTING LABORATORY	L	T	P	C
		0	0	2	1

Co-requisite:	15CE302		
Prerequisite:	NIL		
Data Book / Codes/Standards	NIL		
Course Category	P	PROFESSIONAL CORE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	To expose students to the use of MS Excel and structural analysis software packages for solving civil engineering problems and provide hands on experience on testing of structural systems to understand their behavior.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course, student will be able to	
1.	Use Ms Excel to solve problems like design of beams, matrix method of structural analysis	b
2.	Use STAAD. Pro and ETABS to analyze and design structural systems	b
3.	Understand the behavior of RCC / steel beams under flexure, shear, torsion by carrying out appropriate tests .	b

COMPUTER LAB

Sl.No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Programming in MS Excel for the calculation of A_{st} for singly reinforced beams by LSM	2	O	1	1, 2, 3, 4
2.	Solving matrix equation and finding member forces by stiffness method.	2	O	1	1, 2, 3, 4
	Using STAAD.Pro / STAAD Foundation to analyze and design following structures, including the dynamic analysis				
3.	Plane steel frames	2	O	2	1, 2, 3, 4
4.	2D moment resistant RC frames	2	O	2	1, 2, 3, 4
5.	3D moment resistant RC frames	2	O	2	1, 2, 3, 4
	Using SAP / ETABS analyze and design for following structures, including the dynamic analysis				
6.	Plane steel frames	2	O	2	1, 2, 3, 4
7.	2D moment resistant RC frames	2	O	2	1, 2, 3, 4
8.	3D moment resistant RC frames	2	O	2	1, 2, 3, 4

STRUCTURAL ENGINEERING LAB

9.	Testing of RCC beams under flexure	2	O	2	1
10.	Testing of RCC beams under shear	2	O	2	1
11.	Testing of RCC beams under torsion	2	O	2	1
12.	Testing of castellated steel beam	2	O	2	1
13.	Testing of frames for lateral loads	2	O	2	1
14.	Slab testing	2	O	2	1
15.	Model analysis using Muller Breslau principle	2	O	2	1
	Total contact hours	**30**			

LEARNING RESOURCES	
Sl.No.	REFERENCES
1.	Laboratory Manual
2.	*https://www.bentley.com/en/products/brands/staad*
3.	*https://www.csiamerica.com/products/etabs*

4.	*https://www.csiamerica.com/products/sap2000*

Course nature		**PRACTICAL**			
Assessment Method					
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination
	Weightage	**40%**	**5%**	**5%**	**10%**
End semester examination Weightage : 40%					

				L	T	P	C
15CE304	**HYDROLOGY AND IRRIGATION ENGINEERING DESIGN**			1	2	0	2
Co-requisite:	NIL						
Prerequisite:	NIL						
Data Book / Codes/Standards	NIL						
Course Category	P	PROFESSIONAL CORE	WATER RESOURCES ENGINEERING				
Course designed by	Department of Civil Engineering						
Approval	32nd Academic Council Meeting , 2016						

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**			
At the end of the course, student will be able					
1.	To study the hydrologic cycle, precipitation, runoff and its estimation.	a	c	e	
2.	To study the occurrence, movement and augmentation of ground water through Darcy's law, recuperation test, pumping test and artificial recharge methods.	a	c	e	
3.	To know the importance, features and uses of diversion and impounding structures	a		e	
4.	To explore the importance of rivers, reservoirs and silt control.	a	c	k	
5.	To learn about basics of irrigation, consumptive use and design a channel through Kennedy's theory, Lacey's theory.	a	c	e	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: SURFACE WATER HYDROLOGY	**8**			
1.	Introduction - overview of syllabus – Hydrologic cycle	1	C	1-4	1-7
2.	Precipitation – forms and types – Measurement of precipitation – Recording and Non-recording rain gauge - Rain gauge density	1	C, I	1	1, 2, 7
3.	Mean areal depth of precipitation – Arithmetic average method – Thiesson polygon method – Isohyetal method	2	C, I		1, 2, 7
4.	Estimation of missing precipitation – Optimum rain gauge network design - Probable maximum precipitation	2	C, D, I	1	1, 2, 7
5.	Runoff process – Components of stream flow – Factors affecting runoff – Estimation of runoff – Emphirical formulae and Infiltration method – introduction to software to analyze storm water system including rainfall, runoff, detention periods.	2	C, I	1	1, 2, 7
	UNIT II: GROUND WATER HYDROLOGY	**8**			
6.	Occurrence of ground water – Porosity – Permeability and transmissibility - Zones of subsurface water	1	C	2	1, 2, 5, 6, 7
7.	Movement of ground water - Darcy's Law – Specific yield and Specific retention - Aquifers and their types- Specific capacity – Coefficient of storage - Infiltration wells and Infiltration galleries	2	C, I	2	1, 2, 5, 6, 7
8.	Open wells -Tube wells – Types of tube wells - Yield of an open well - Pumping test – Recuperation test	2	C, I	2	1, 2, 5, 6, 7
9.	Steady radial flow to a well located in	3	C, I	2	1, 2, 5, 6, 7

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	unconfined and confined aquifers – Dupuit's and Thiem's equilibrium formulae - Spacing of wells - Artificial recharge methods.				
	UNIT III: DIVERSION AND IMPOUNDING STRUCTURES	**12**			
10.	Weirs and barrages – Gravity and non-gravity weirs – Diversion head works and its components, simple explanation about weir proper, under sluices, divide wall, fish ladder, canal head regulator, weirs ancillary works such as shutters, gates etc, silt regulation works	2	C	3	1, 3, 4, 6
11.	Failure of hydraulic structures – Failure by piping and failure by direct uplift, Bligh's creep theory, Lane's weighted creep theory and Khosla's theory	2	C	3	1, 6
12.	Khosla's method of independent variables for determination of pressures and exit gradient for seepage below a weir or a barrage. Design of pucca floor and aprons.	2	C, D, I	3	1, 6
13.	Dams – Definition and uses - Classification – Factors governing the selection of a particular type of dam – Selection of dam site - Problems in dam construction	2	C, I	3	1, 3, 4, 6
14.	Gravity dam - Forces acting on a gravity dam - Modes of failure and criteria for structural stability	2	C	3	1, 3, 4, 6
15.	Construction of gravity dam – Functions and types of galleries - Types of earthen dam – Causes of failure of Earthen dams	2	C, I	3	1, 3, 4, 6
	UNIT IV: RESERVOIR PLANNING	**8**			
16.	Rivers - Types and characteristics – Classification based on the basis of the topography of the river basin, Classification based on the basis of flood hydrogaphs, Indian rivers and their classification	1	C	4	1, 3, 4, 6
17.	Behaviour of rivers – Straight reaches, Bends, Meanders – Causes of meandering, Cutoff – River training - Classification	1	C	4	1, 3, 4, 6
18.	Types of training works – Guide bank – Groynes – Types of groynes – Artificial cutoff – Pitched island	1	C	4	1, 3, 4, 6
19.	Reservoir - Types – Suitable site for reservoir - Storage capacity of reservoir - Area-Elevation curve and Storage Elevation curve - Storage zones	2	C	4	1, 3, 4, 6
20.	Reservoir yield – Safe yield, Design yield, Secondary yield, Average yield - Mass curve and Demand curve - Designing reservoir capacity for a given yield – Designing yield from a reservoir of a given capacity	2	C, D, I	4	1, 3, 4, 6
21.	Reservoir Losses - Reservoir sedimentation - Silt control – Pre constructing measures and Post constructing measures	1	C, I	4	1, 3, 4, 6
	UNIT V: IRRIGATION	**9**			
22.	Irrigation - Necessity – Advantages and disadvantages – Soil-water-plant relations – Hygroscopic water, Capillary water ,	2	C, I	5	1, 3, 4, 6

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Gravitational water, Field capacity, Permanent wilting point, Available moisture, Readily available moisture – Depth of water stored in root zone				
23.	Limiting soil moisture conditions – Depth and frequency of irrigation - Crop season - Duty and Delta – Factors affecting duty – Methods of improving duty	2	C, I	5	1, 3, 4, 6
24.	Consumptive use - Estimation - Blaney Criddle method - Pan evaporation method	2	C, I	5	1, 3, 4, 6
25.	Canal – Alignment of canals - Distribution system – Channel losses	1	C	5	1, 3, 4, 6
26.	Description, functions and uses of Tank sluice, Tank weir, Canal regulator, Cross regulator, Canal fall, Canal escapes and Cross drainage works	2	C	5	1, 3, 4, 6
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Santhosh Kumar Garg, *"Irrigation Engineering and Hydraulic Structures"*, Khanna Publishers, 2000.
2.	Raghunath .H.M, *"Hydrology"*, New Age International Publishers, New Delhi, 2007.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Asawa .G.L, *"Irrigation and Water Resources Engineering"*, New Age International Publishers, New Delhi, 2005.
4.	Sharma .R.K, *"Irrigation Engineering and Hydraulic Structures"*, Oxford and IBH Publishing Company, New Delhi, 2002.
5.	Raghunath .H.M, *"Ground Water Hydrology"*, Wiley Eastern Ltd., Second reprint, 2000.
6.	Punmia B.C. and Pande B.B. Lal, " *Irrigation and Water Power Engineering*", Laxmi Publications Pvt. Ltd., New Delhi, 2009
7.	Subramanya K, "Engineering Hydrology", McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2014

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE306M	WATER SUPPLY AND ENVIRONMENTAL ENGINEERING AND DESIGN		L	T	P	C
			1	2	0	2
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	IS:10500-2012					
Course Category	P	PROFESSIONAL CORE	ENVIRONMENTAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To learn the fundamental concepts in the field of water supply and environmental engineering and design of water supply schemes and treatment units.			
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able to				
1.	Know the basics, importance, and methods of water supply.	a		
2.	Study the various sources and properties of water.	a		
3.	Understand the various methods of conveyance of water.	c	e	
4.	Learn the objectives and methods of water treatment and study the features and function of different water treatment units.	a	c	e
5.	Learn the importance of rain water harvesting and water pollution.	a		

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I - INTRODUCTION TO WATER SUPPLY	**9**			
1.	Environmental Engineering - Role of Environmental Engineer - Water supply – and its need-development-scheme-quantity of water	2	C	1-4	1
2.	Sources of water- estimating requirements - Design period – per capita consumption - fluctuations in demand pattern	3	C,D	1	2,3
3.	Population forecast– Arithmetic, Incremental	2	C,D	1	1,3
4.	Geometric methods, Zoning methods, Simple graphical method.	2	C,D	1	1,3
	UNIT II-QUALITY & STANDARDS OF WATER	**9**			
5.	Intake structures	3	C	2	2,3
6.	Quality of water - physical, chemical and biological aspects	3	C	2	3,4
7.	Analysis of water - water quality standards.	3	D,I	2	4
	UNIT III - CONVEYANCE & DISTRIBUTION SYSTEM	**9**			
8.	Hydraulics of flow in pipes - Pipe materials - laying, jointing, testing of pipes	2	C,D	3	1,3
9.	Pumping stations - selection of pumps - methods of distributing water- storage and distribution reservoirs	2	C,D,I	3	1
10.	Analysis of distribution system Hardy- cross method of balancing	3	C,D,I	3	3,4
11.	equivalent pipes –Introduction to SWMM, LOOP distribution system software.	2	C,D,I	3	3,4
	UNIT IV -WATER TREATMENT	**9**			
12.	Definition of unit process and unit operations - objectives of water treatment - methods &	2	C	4	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	sequence of treatment of water - typical flow sheet treating hard groundwater turbid surface water				
13.	Coagulation, flocculation filtration and disinfection	2	D,I	4	1,3
14.	Principles functions of design - sedimentation	2	D,I	4	2,3
15.	flocculation- filter units miscellaneous methods	2	D,I	4	2,3
16.	Water softening- Iron and manganese removal – de-fluoridation and demineralization.	1	D,I	4	1,2
	UNIT V - WATER MANAGEMENT AND ENVIRONMENT	**9**			
17.	Sustainable Development	2	D,I	5	5
18.	Rain Water harvesting-Methods	2	D,I	5	5
19.	Water Pollution- Causes and effects of water pollution	2	C	5	2,5
20.	Role of regulatory bodies& Local bodies-CPCB-TWAD Board-CMWSSB etc-Water Act 1974	3	C	5	4,5
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Garg .S.K., "*Environmental Engineering*", Vol. I, Khanna Publishers, New Delhi, 2014.
2.	Duggal .K.N, "*Elements of Environmental Engineering*", S. Chand & Company Ltd., New Delhi, 2012.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Paneerselvam .R "*Environmental Engineering*", Vol. I, SPGS Publishers Chennai, 2010.
4.	"*Manual on Water Supply and Treatment*," CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2009.
5.	Goel .P.K. "*Water Pollution Causes ,Effects and Control*", " New age International Publishers " 2011

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE308		**GEOTECHNICAL ENGINEERING II**		**L**	**T**	**P**	**C**
				2	**2**	**0**	**3**
Co-requisite:		NIL					
Prerequisite:		15CE309 **-** GEOTECHNICAL ENGINEERING I					
Data Book / Codes/Standards		NIL					
Course Category	P	PROFESSIONAL CORE	GEOTECHNICAL ENGINEERING				
Course designed by		Department of Civil Engineering					
Approval		32nd Academic Council Meeting , 2016					

PURPOSE	To develop an understanding of the behavior of foundations for engineering structures and to gain knowledge of the design methods that can be applied to practical problems.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able to				
1.	Get familiarized with a basic understanding of the essential steps involved in a geotechnical site investigation.	a	e	
2.	Learn the principle types of foundation and the factors governing the choice of the most suitable type of foundation for a given solution, settlement of foundation.	a	e	k
3.	Get familiarized with the procedures used for: a) bearing capacity estimation, b) load carrying capacity of pile c) determining earth pressure and d) concept on stability of slope.	a	e	k

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: SITE INVESTIGATION AND SELECTION OF FOUNDATION	**12**			
1	Introduction- planning and stages in sub-surface exploration	1	C	1	1,2
2	Depth and spacing of exploration	1	C	1	1,2
3	Methods of exploration – Test pit- Trenches – Boring methods –Auger, Shell and Auger, wash boring, Rotary and percussion borings	3	C	1	1,2
4	Geophysical methods – Seismic refraction and Electrical resistivity method	2	C	1	1,2
5	Types of soil samples – disturbed and undisturbed samples - problems – Features of sampler affecting soil disturbance.	2	C,D,I	1	1,2
6	Standard penetration test – Corrections - problems – Static and Dynamic cone penetration test – bore log report	3	C,D,I	1	1,2
	UNIT II: BEARING CAPACITY – SHALLOW FOUNDATION	**12**			
7	Bearing capacity – definition -Types of failure	1	C	3	1,2
8	Bearing capacity of shallow foundation on homogenous deposits- Terzaghi's methods- problem	3	C,D,I	3	1,2
9	Bearing capacity - Skempton's methods- problem	1	C,D,I	3	1,2
10	Bearing capacity - BIS methods- problem	2	C,D,I	3	1,2
11	Effect of Water Table on bearing capacity- problem	2	C,D,I	3	1,2
12	Bearing capacity from in-situ tests – SPT, SCPT and Plate load test	2	C	3	1,2
13	Methods of improving bearing capacity	1	C	3	1,2
	UNIT III: FOOTINGS, RAFTS AND SETTLEMENT OF FOUNDATION	**12**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
14	Types of foundation	1	C	2	1,2,3
15	Contact pressure distribution below isolated footing	1	C	2	1,2,3
16	Types and proportioning of combined footing (Rectangular and Trapezoidal) - Problem	4	C,D,I	2	1,2,3
17	Types and application of mat foundation – Floating foundation	1	C	2	1, 2.
18	Settlement : Total and differential settlements	2	C	2	1,2,3
19	Causes and methods of minimizing settlement.	3	C	2	1,2,3
	UNIT IV: DEEP FOUNDATION	**12**			
20	Types and function of piles – Factors influencing the selection of pile	2	C	3	1,2,3,4
21	Load carrying capacity of single pile in cohesionless and cohesive soil – Static formulae- problem	2	C,D,I	3	1,2,3,4
22	Dynamic formulae (Engineering News and Hileys) - problem	2	C,D,I	3	1,2,3,4
23	Load carrying capacity from in-situ tests (SPT and SCPT) - Pile load test	2	C	3	1,2,3,4
24	Load carrying capacity of Pile group- problem	2	C,D,I	3	1,2,3,4
25	Negative skin friction – Under-reamed piles, Introduction to well foundation - Diaphragm walls	2	C	3	1,2,3,4
	UNIT V: EARTH PRESSURE AND STABILITY OF SLOPES	**12**			
26	Earth pressure in soils: active and passive states- problem	2	C,D,I	3	1,2,3,5
27	Lateral earth pressure- Rankine's Theory- Stratified soil- problem	4	C,D,I	3	1,2,3,5
28	Culmann's Graphical method	2	C	3	1,2,3,5
29	Slopes- Finite and Infinite slopes-Types of failure- Causes of failure-Remedial measures	2	C	3	1,2,3,5
30	Procedure for slip circle method and method of slices	2	C	3	1,2,3,5
	Total Contact hours		**60**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1	Joseph.E Bowles, "*Foundation Analysis and Design*", Mc Graw Hill Publishing co., 2001.
2	Murthy .V.N.S, "*Textbook of Soil Mechanics and Foundation Engineering*", CBS Publishers and Distributors, New Delhi, 2009.
Sl.No	**REFERENCE BOOKS/OTHER READING MATERIAL**
3	Arora .K.R. "*Soil Mechanics and Foundation Engineering*", Standard Publishers and Distributors, New Delhi, 2011.
4	Varghese, P.C., "*Foundation Engineering*", PHI Learning New Delhi. 2011
5	Punmia.B.C., "*Soil Mechanics and Foundations*", Laxmi publications Pvt Ltd., 2000.
6	Das .B.M, "*Principles of Foundation Engineering*", (Fifth Edition), Thomson Books, 2010.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

	15CE310	PRINCIPLES OF CONSTRUCTION MANAGEMENT	L	T	P	C
			2	1	0	2

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE CONSTRUCTION MANAGEMENT
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To learn the fundamental concepts of construction management principles in the field of construction engineering and management.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES			
At the end of the course, student will be able					
1.	To know about the basics and importance of construction management andcash flow concepts.	a			
2.	To study about the construction contract documents.	d	e	k	
3.	To impart the idea about planning and scheduling of activities and scheduling.	a	e	d	
4.	To study about the quality and safety in construction sites.	a	e	k	
5.	To study about optimization techniques of construction resources	a			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I - CONSTRUCTION PROJECT FORMULATION	**9**			
1.	Introduction - Project Management: An Overview – Types, Project Organization	2	C	1	1,2,3,5
2.	Characteristics of Projects – Project life cycle.	1	C	1	1,2,3,5
3.	Project Appraisal – Feasibility study	1	C	1	1,2,3,5
4.	Introduction to Time value of money	1	C	1	1,2,3,5
5.	Net Present Value, Benefit Cost Ratio with problems	2	C,I	1	1,2,3,5
6.	Evaluation of Public Projects – BOOT, BOT, BOLT concepts.	2	O	2	1,2,3,5
	UNIT II - CONSTRUCTION CONTRACT	**9**			
7.	Indian Contracts Act 1872 – Basic Terminologies	2	C, I	2	1,2,3,5
8.	Engineering contract classification, Sub contracts	2	C, I	2	1,2,3,5
9.	CPWD – FIDIC form of contract methods	1	C	2	1,2,3,5
10.	Arbitration	2	C	2	1,2,3,5
11.	Tender – Basics of evaluation	2	C	2	1,2,3,5
	UNIT III - CONSTRUCTION PLANNING & SCHEDULING	**9**			
12.	Introduction – types of project plans - work breakdown structure	1	C	3	1,2,3,5
13.	Planning techniques - bar charts - preparation of network diagram -	1	C, I	3	1,2,3,5
14.	Critical Path Method Problems	3	C, I	3	1,2,3,5
15.	Program Evaluation And Review Technique With Problems	3	C, I	3	1,2,3,5
16.	Basics of Resource Management	1	C	3	1,2,3,5
	UNIT IV - CONSTRUCTION QUALITY AND SAFETY MANAGEMENT	**9**			
17.	Construction quality - inspection, quality control and quality assurance	2	C	4	4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
18.	Total quality management - quality gurus and their teachings	2	C, I	4	4
19.	ISO standards - audit - evaluation of safety -	1	C	4	4
20.	Accident causation theories - health and safety act and regulations	2	C	4	4
21.	Role of safety personnel - causes of accidents - principles of safety - safety and health management system	2	C, I, O	4	4
	UNIT V: APPLICATION OF OPERATION RESEARCH TECHNIQUES IN CONSTRUCTION	**9**			
22.	Introduction -concepts in probability and statistics	1	C	5	6
23.	linear programming by Graphical Method- Different types of LPP Solution	2	C, I	5	6
24.	Transportation Problems	2	C, I	5	6
25.	Assignment Problems	2	C, I	5	6
26.	Simulation Techniques- Introduction to Monte Carlo Method simulation- functions of random variables	2	C, I, O	5	6
	Total contact hours	**45**			

	LEARNING RESOURCES
Sl.No.	**TEXT BOOKS**
1.	Kumar NeerajJha, "*Construction project management*", Dorling Kindersley,New Delhi.2013
2.	Sengupta .B, Guha .H, "*Construction management and planning*", TataMcgrawHill,New Delhi,2001.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Sharma .S.C, "*Construction engineering and management*",KhannaPublishers,Delhi,2008.
4.	Murugesan .G, "*Total quality management*",Laxmi Publications,Delhi,2013
5.	Prasanna Chandra, "*Planning, Analysis, Selection, Financing, Implementation, and Review*", 7th Edition,TataMcgrawHill,New Delhi,2001.
6.	PannerSelvam, "*Operation research*" , PHI India Private limited, New Delhi, 2011.

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE312L	COMPUTER APPLICATIONS IN CONSTRUCTION MANAGEMENT	L	T	P	C
		0	0	4	2

Co-requisite:	15CE310
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P	PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To acquire practical exposure about preparation of drawings, readings, construction project planning , scheduling, resource allocation and tracking of projects using the software tools

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES			
At the end of the course, student will be able					
1.	To preparation of plan, elevation and sections of various types of buildings using AutoCAD	b	d		
2.	To acquire knowledge in preparation of planning and scheduling of construction projects by using MS Projects	d	e	k	
3.	To acquire knowledge in preparation of planning and scheduling of construction projects by using Primavera	d	e	k	

Sl.No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Preparation of plan, elevation and section of residential buildings-single storey and double storey (load bearing structures)	4	D	1	5, 7
2.	Preparation of plan, elevation and section of institutional buildings - school.(framed structure)	6	D, I	1	5, 7
3.	Preparation of plan, elevation and section of industrial buildings workshop (steel structure)	6	D, I	1	5, 7
4.	Basic concepts of construction planning, scheduling, control and its uses in MS Project and Primavera.	4	C	2	2 ,3, 6
5.	Planning, scheduling and resource assigning in residential building by using MS Project.	12	I, O	2	6
6.	Planning, scheduling and resource assigning in infrastructure by using MS Project.	8	I, O	2	6
7.	Planning, scheduling and resource assigning in industrial buildings by using Primavera	12	I, O	3	2, 3
8.	Planning, scheduling and resource assigning in the interior design of hotel management by using primavera.	8	I, O	3	2, 3
	Total contact hours			**60**	

LEARNING RESOURCES	
Sl.No.	REFERENCES
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
4.	Paul F. Aubin, *"Mastering Autodesk Revit Building"*, Cengage Learning, March 2006.
5.	Robert M. Thomas, *"Advanced AutoCAD Release" 12*, ED 3, Wiley, John & Sons, Incorporated, 1993.
6.	*"Project planning and management: MS Project specially for Civil professional"*, CADD

	Centre training services
7.	Geprge Omura," *Introducing AutoCAD 2010 and AutoCAD LT 2010"*, Willey India Pvt. Ltd., 2010.

Course nature					Practical		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**	
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**	
					End semester examination Weightage :		**40%**

15CE401		ADVANCED RCC DESIGN		L	T	P	C
				1	2	0	2
Co-requisite:	NIL						
Prerequisite:	15CE204						
Data Book / Codes/Standards	IS : 456-2000, SP – 16, IS : 1343:2012, IRC 6-2010						
Course Category	P	PROFESSIONAL CORE		STRUCTURAL ENGINEERING			
Course designed by	Department of Civil Engineering						
Approval	32nd Academic Council Meeting, 2016						

PURPOSE	To bring about an exposure to advanced topics in structural design comprising of RCC retaining walls, water tanks, yield line theory, flat slabs, design of bridges and prestressed concrete.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES		
At the end of the course, student will be able				
1.	Design RCC cantilever and counterfort retaining walls	a	c	e
2.	Design different type of water tanks including underground and overhead tanks	a	c	e
3.	Create an awareness on yield line theory of slabs and to design flat slabs	a	c	e
4.	Design RCC slab culvert, girder bridge and to draw ILD for simple spans.	a	c	e
5.	Analyse prestressed concrete sections and design of beams.	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I- RCC RETAINING WALLS	**9**			
1.	Introduction to Retaining Walls	1	C	1	2,4
2.	Design of cantilever retaining walls	4	C,D,I	1	2,4
3.	Design of counterfort retaining walls	4	C,D,I	1	2,4
	UNIT II- RCC WATER TANKS	**9**			
4.	Design of rectangular water tanks	2	C,D,I	2	3,4,5,6,10
5.	Design of circular water tanks	1	C,D,I	2	3,4,5,6,10
6.	Design of Underground Water Tanks	2	C,D,I	2	3,4,5,6,10
7.	Design of overhead water tank and Intze type tanks	2	C,D,I	2	3,4,5,6,10
8.	Design of Staging with columns and beams, Shaft and conventional types	2	C,D,I	2	3,4,5,6,10
	UNIT III: FLAT SLABS AND YIELD LINE THEORY	**9**			
9.	Concept and Advantages of Flat Slab,	1	C	3	2,3
10.	Design of flat slab using Direct Design method as per BIS code, use of design aids (SP16)	3	C,D,I	3	2,3
11.	Introduction to yield line theory	1	C	3	2,3
12.	Design of square and rectangular slabs for collapse loads using Yield line theory of slabs	2	C,D,I	3	2,3
13.	Design of circular and triangular slabs for collapse loads using Yield line theory of slabs	2	C,D,I	3	2,3
	UNIT IV: DESIGN OF BRIDGES	**9**			
14.	Types of bridges and culverts	1	C	4	7,8
15.	Simply supported girder bridges, Balanced cantilever and their behavior	1	C	4	7,8
16.	Introduction to IRC Loading, impact loading	1	C,D	4	7,8
17.	Codal Provisions for design	1	C,D	4	7,8
18.	Design of slab culvert for Class AA, 70R, Class A	3	C,D,I	4	7,8
19.	Loads on T-beam girder bridges using Courbans theory	1	C,D,I	4	7,8
20.	Drawing ILD diagram for simple spans and	2	C,D	4	7,8

	calculation of design Bending moment, shear force for class AA and class A loading				
	UNIT V: PRESTRESSED CONCRETE STRUCTURES	**9**			
21.	Basic concepts, Principle of prestressing methods and materials required	2	C,D	5	3
22.	Stress and Strength concept and Load balancing concept	1	C,D	5	3
23.	Analysis of sections subjected to flexure, Losses of prestress using Simple cable profile	4	C,D	5	3
24.	Introduction to design of beams	2	C	5	3
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Varghese.P.C, "*Advanced Reinforced Concrete Design*", Pretince-Hall India, 2005.
2.	Unnikrishna Pillai.S and Devadas Menon, "*Reinforced Concrete Design,*" Tata MacGraw Hill Publishing Company Limited, Second Edition, New Delhi, 2010.
3.	Krishnaraju .N, Pranesh .R.N, "*Design of Reinforced concrete IS : 456-2000*", New age International Publication (P) Ltd., New Delhi, 2003.
4.	Ramamrutham.S, "*Design of Reinforced concrete Structures*", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2015.
	REFERENCE BOOKS/OTHER READING MATERIAL
5.	Krishnaraju .N, "*Prestressed Concrete*", Tata McGraw-Hill Education, 2008, New Delhi.
6.	Punmia.B.C, Ashok Kumar Jain, Arun Kumar Jain, "*Limit State Design of Reinforced Concrete*", Laxmi Publications, New Delhi, 2007.
7.	Jain.A. K, "*Reinforced Concrete Structures*", Nem Chand & Brothers, Roorkee, 2002.
8.	Johnson Victor.D, "*Essentials Of Bridge Engineering*", 6/E, Oxford & IBH Publishing Company Pvt. Ltd.,Fourth edition, 2007.
9.	Krishna Raju.N, "*Design of Bridges*", Oxford & IBH Publishing Company Pvt. Ltd.,Fourth edition, 2010.
10.	Vazirani.V.N and Ratwani.M.M, "*Design of Reinforced concrete Structures*", 16th Edition,Khanna Publishers, New Delhi,

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE403		ADVANCED STEEL DESIGN		L	T	P	C
				1	2	0	2

Co-requisite:	NIL
Prerequisite:	15CE303
Data Book / Codes/Standards	IS : 800-2007, Steel Tables(Revised), IS : 875-Part 1,2 & 3
Course Category	P	PROFESSIONAL CORE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To develop knowledge in designing special steel structures

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES		
At the end of the course, student will be able to				
1.	Design eccentric and moment resistant connections	a	c	e
2.	Design beam-columns, plate girder and gantry girder	a	c	e
3.	Design column bases and eccentrically loaded base plate	a	c	e
4.	Analyze and design roof truss and connections of industrial structures	a	c	e
5.	Understand design principle of pre-engineered buildings and towers	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I-ECCENTRIC AND MOMENT RESISTANT CONNECTIONS	**9**			
1.	Simple, Semi-rigid and Rigid Connections-Connection configurations	2	C	1	1-10
2.	Beam to Column connections-Stiffened Seat angle connections	2	C,D,I	1	1-10
3.	Bracket connections – Moment resistant connections	3	C,D,I	1	1-10
4.	Beam and Column Splices	2	C,D,I	1	1-10
5.	**UNIT II-BEAM-COLUMNS**	**9**			
6.	Behavior of short and long beam-columns	2	C	2	1-10
7.	Interaction Formula-Design approach to beam-columns (design principle only)	2	C,D	2	1-10
8.	Design of Plate Girder-General design considerations-Design procedure	2	C,D,I	2	1-10
9.	Design of Gantry Girder-Maximum load effects	3	C,D,I	2	1-10
10.	**UNIT III-COLUMN BASES**	**9**			
11.	Introduction to column bases and footings-types	2	C	3	1-10
12.	Design of slab base	2	C,D,I	3	1-10
13.	Design of gusseted base	2	C,D,I	3	1-10
14.	Design of base plate and connections with anchor bolts subjected to tension	3	C,D,I	3	1-10
	UNIT IV-INDUSTRIAL BUILDINGS	**9**			
15.	Structural Framing-Functions of Components-Types of roof trusses for different spans	1	C	4	1-11
16.	Estimation of dead, live and wind loads – Load combinations	2	C,I	4	1-11
17.	Analysis of roof truss	2	C,I	4	1-10
18.	Design of roof truss	1	C,D,I	4	1-11
19.	Design of Purlins	2	C,D,I	4	1-11

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
20.	Structural Behavior and Design of Connections	1	C,D,I	4	1-11
	UNIT V-PRE-ENGINEERED BUILIDINGS AND TOWERS	**9**			
21.	Components and Structural behavior of Pre-engineered buildings	1	C	5	1-10
22.	Design aspects	2	C,D	5	1-10
23.	Design of Connections	1	C,D	5	1-10
24.	Classification of Towers-Loads and their combinations-Wind Effects	1	C,D,I	5	1-10
25.	Methods of Analysis of Communication Towers	2	C,I	5	1-10
26.	Design principle-Foundation for Towers	2	C,D,I	5	1-10
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Subramanian.N, *"Design of Steel Structures-Limit State Method"*, Oxford University Press, New Delhi, 2016
2.	Duggal .S.K, *"Limit State Design of Steel Structures"*, Tata McGraw Hill Publishing Company, New Delhi, 2010.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Gaylord,E.H.,Gaylord,N.C., and Stallmeyer,J.E., *"Design of Steel Structures"*, McGraw Hill Pub.,1992.
4.	Ramamrutham .S., *"Design of Steel Structures"*, Dhanpat Rai Pub., 2013.
5.	Vazirani .V.N, "Design and Analysis of *Steel Structures"*, Khanna Publishes, 2003.
6.	Ramachandra .S, Virendra Ghelot, *"Limit State Design of Steel of Structures"*, Scientific Publishers, New Delhi,2012.
7.	Arya.A.S. & Ajmani.J.L., *"Design of Steel Structures"*, Nemchand & Bros., 2011.
8.	Dayarathnam .P, *"Design of Steel Structures"*, S.Chand and Company Ltd. , 2008.
9.	Kazimi. S. M. A. and Jindal. R. S., *"Design of Steel Structures"*, 2nd Edition, Prentice Hall of India,1988.
10.	Shiyekar.,M.R, *"Limit State Design in Structural Steel "*, PHI Learning, New Delhi, 2013.
11.	IS: 875(Parts 1,2,3): *"Code of Practice for Design Loads on Buildings and Structures"*, BIS, New Delhi, 1987 (Reaffirmed 2003)

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE405		SANITARY ENGINEERING AND DESIGN	L	T	P	C
			1	2	0	2
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL CORE	ENVIRONMENTAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To familiarize about the importance and methods of sewage treatment and solid waste with special attention to design and application.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES		
At the end of the course, student will be able to				
1.	Know the basics of sewage, types of sewers and sewer material.	a		
2.	learn the features of various sewer appurtenances.	a		c
3.	Learn the objectives and methods of sewage treatment and study the features and function of different primary treatment units.	a		e
4.	Study the features and function of different secondary treatment units.	a	c	e
5.	Learn the objectives and methods of sewage disposal and methods of solid waste and sludge management.	a		e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I - SANITATION	**9**			
1.	Sewage - Characteristics of sewage- sewer, sewage and sewerage - Components of sewerage system - Conservancy system, Water carriage system	3	C	1-4	1-4
2.	Classification of sewerage systems - quantity of sanitary sewage - Variation in sewage flow	2	C	1	1,3,4
3.	Design of flow of sewage for separate, storm and combined sewers – full flow	2	C,D	1	1,3,4
4.	partial flow conditions - design of separate sewers using Manning's formula-Introduction to SEWER software package- custom-made sewer design using MS-Excel	2	C,D	1	1,3,4
	UNIT II - SEWER MATERIALS, CONSTRUCTION AND APPURTENANCES	**9**			
5.	Materials for pipe sewers - construction - laying ,jointing, dewatering and testing	2	C	2	1,3,4
6.	Sewer appurtenances - traps	3	C,D	2	1,2
7.	Plumbing system of drainage - one pipe system	2	D,I	2	1,2
8.	two pipe system of plumbing - sanitary fittings	2	D,I	2	1,2
	UNIT III - SEWAGE TREATMENT	**9**			
9.	Objective - Unit Operation and Processes - Selection of treatment processes	1	C,D	4	2,3,4
10.	Onsite sanitation - Septic tank, Grey water harvesting	3	C,D,I	4	2,3,4
11.	Primary treatment - Principles, functions and design of screen	3	C,D	4	2,3,4
12.	Grit chambers and primary sedimentation tanks	2	C,D	4	2,3,4
	UNIT IV - SECONDARY TREATMENT	**9**			
13.	Objective -Selection of Treatment Methods - Principles, Functions and Design of treatment	2	C	4	3,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Units				
14.	Activated Sludge Process and Trickling filter	2	D,I	4	3,4
15.	Other treatment methods - Oxidation ditches, UASB - Waste Stabilization Ponds	3	D,I	4	3,4
16.	Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction and Operation & Maintenance of Sewage Treatment Plants	2	D,I	4	3,4
	UNIT V - SEWAGE DISPOSAL, SLUDGE MANAGEMENT AND SOLID WASTE MANAGEMENT	**9**			
17.	Sewage Disposal - Dilution - self purification of running streams	1	D,I	4,5	3,4
18.	Oxygen sag curve land disposal - sewage farming - deep well injection - soil dispersion system.	3	C	4,5	4
19.	Objectives of sludge treatment - properties and characteristics of sludge - sludge digestion - thickening - dewatering - conditioning -	3	C	4,5	2,3,4
20.	Sludge drying beds - biogas recovery. solid waste -generation-collection-conveyance-disposal.	2	C	4,5	4
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No	**TEXT BOOKS**
1.	Garg .S.K "*Sewage Disposal & Air Pollution,*" Khanna Publishers, New Delhi, 2004.
2.	Duggal.K.N, "*Elements of Environmental Engineering*", S. Chand & Company Ltd., New Delhi, 2002.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Paneerselvam .R "*Environmental Engineering*", Vol. II, SPGS Publishers Chennai, 2006.
4.	"*Manual on Sewerage & Sewage Treatment*", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2009.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE407L	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

Prerequisite:	15CE306M				
Data Book / Codes/Standards	NILl				
Course Category	P	Professional Course			
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	This subject helps to gain knowledge on characteristics of water and waste water.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES
At the end of the course, student will be able to		
1.	Get hand-on experience in the operation of equipment's like pH meter, TDS meter, turbidity meter, etc.	b
2.	Know the drinking water quality standards and the waste water disposal standards	b
3.	Gain knowledge in importance of treatment of water and waste water	b

Sl.No	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Introduction	2	O	1	1,2
2.	Measurement of pH	2	O	1	1,2
3.	Estimation of Optimum Coagulant Dose by Jar Test	2	O	1	1,2
4.	Measurement of Conductivity	2	O	1	1,2
5.	Estimation of Suspended, Settleable, Volatile and fixed solids.	2	O	1-3	1-3
6.	Estimation of Dissolved Oxygen	2	O	1,2	1-3
7.	Determination of Turbidity by using Nephlometer	2	O	1,3	1
8.	Determination of Iron and Fluoride	2	O	1	1
9.	Estimation of Chlorides	2	O	1	1
10.	Estimation of Residual Chlorine	2	O	1	1,2
11.	Estimation of Alkalinity	2	O	1	1
12.	Estimation of Hardness by EDTA method	2	O	1,2	1
13.	BOD test for water and waste water.	2	O	1,3	1-3
14.	COD test for water and waste water.	2	O	1,2	1-3
15.	Introduction to Bacteriological Analysis	2	O	1,3	1
	Total contact hours	**30**			

LEARNING RESOURCES	
Sl.No.	REFERENCES
1.	Garg .S.K, "*Environmental Engineering*", Vol. I, Khanna Publishers, New Delhi, 2004
2.	IS:10500-2012 "*Indian Standards for Drinking Water"*, Bureau of Indian Standards, New Delhi.
3.	IS:2490-1981,"*Indian Standards for Industrial and sewage effluent discharge"*, Bureau of Indian Standards, New Delhi.
4.	*"Environmental Engineering lab manual",* Department of Civil Engineering, SRM University(Revised 2015).

Course nature				Practical		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Experiments	Record	Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
				End semester examination Weightage :		**40%**

15CE409	QUANTITY SURVEYING AND VALUATION		L	T	P	C
			1	2	0	2

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE CONSTRUCTION MANAGEMENT
Course designed by	Department of Civil Engineering
Approval	32nd Meeting of academic council, 2016

PURPOSE	To provide hands-on experience on estimation of RCC, steel, masonry buildings and roads and culverts and inculcate the fundamentals of valuation, contracts and tendering

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES		
At the end of the course, student will be able			
1.	To understand the fundamentals of estimation and specification	a		
2.	To provide exposure to rate analysis	a		
3.	To provide hands on experience on estimation	a		
4.	To study the fundamentals of valuation	f	j	k
5.	To carry out valuation by different methods.	f	j	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I - INTRODUCTION TO ESTIMATES AND SPECIFICATIONS	**9**			
1.	Introduction to Quantity surveying – Types of estimates	2	C,O	1	1.2.3.4
2.	Principles in selecting units of measurement for items, various units and modes of measurement for different trades	2	C,O	1	1.2.3.4
3.	Degree of accuracy in measurements, I.S. 1200, Lump sum and Contingency provisions in Estimates	2	C,O	1	1.2.3.4
4.	Specifications – purpose and basic principles of general and detailed specifications	1	C,O	1	1.2.3.4
5.	detailed specifications for various items of work, Approximate estimates, purpose, various methods used for buildings	2	C,O	1	1.2.3.4
	UNIT II - RATE ANALYSIS	**9**			
6.	Taking out quantity, Measurement and abstract sheets and recording	2	C,O	2	1.2.3.4
7.	Categories of Labourers- Material requirements for different items of works- Labour requirement for different items of works	2	C,O	2	1.2.3.4
8.	Standard Data Book- Task or Out turn of labourers -Cost of materials and wages of labour	2	C,O	2	1.2.3.4
9.	Schedule of Rates- Revision of rates- Market Rates	1	C,O	2	1.2.3.4
10.	Cost of conveyance- Handling charges, Preparation of bills of quantities	2	C,O	2	1.2.3.4
	UNIT III - ESTIMATION OF BUILDINGS	**9**			
11.	Reading and interpretation of architectural and structural drawings	1	C,D,O	1,3	1,2,3,5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
12.	Detailed estimate – Load bearing masonry building	2	C,D,I,O	1,3	1,2,3,5
13.	Detailed estimate – Framed structure	2	C,D,I,O	1,3	1,2,3,5
14.	Detailed estimate – Steel Structure	2	C,D,I,O	1,3	1,2,3,5
15.	Bar bending schedule – Slab, Beam, Column & Footing	2	C,D,I,O	1,3	1,2,3,5
	UNIT IV - ESTIMATION OF INFRASTRUCTURES	**9**			
16.	Detailed estimate – Culverts	2	C,D,I,O	1,3	1,2,3,5
17.	Detailed estimate – Roads – road materials for flexible and rigid pavements	2	C,D,I,O	1,3	1,2,3,5
18.	Detailed estimate – bridge	2	C,D,I,O	1,3	1,2,3,5
19.	Detailed estimate – water supply& drainage	2	C,D,I,O	1,3	1,2,3,5
20.	Detailed estimate – Railway projects	1	C,D,I,O	1,3	1,2,3,5
	UNIT V – FUNDAMENTALS AND METHODS OF VALUATION	**9**			
21.	Principles & Purpose of valuation – Types, Mortage & Lease	2	C,O	4,5	1,6,7,8
22.	Problems on valuation, Valuer and his duties, Form of rent, different types of rent	2	C,O	4,5	1,6,7,8
23.	Years' Purchase – Capital cost, Method of valuation	2	C,O	4,5	1,6,7,8
24.	Reversion value of land, annuity perpetual, whole life	2	C,O	4,5	1,6,7,8
25.	Deferred Depreciation – Obsolescence – Sinking fund	1	C,O	4,5	1,6,7,8
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Chakraborti .M," *Estimating Costing"*, Specification and Valuation in Civil Engineering, 2001.
2.	Dutta .B.N, "*Estimating and Costing in Civil Engineering Theory and Practice*," 2000.
3.	Birdie .G.S, "*A Text Book on Estimating and Costing"*, Dhanpat Rai and Sons, New Delhi, 2000.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Joglekar .P.T, "*Practical Information for Quantity Surveyors"*, Mrs. Mandakini Joglekar, Pune,1990.
5.	Rangwala .S.C.," *Elements of Estimating and Costing"*, Charotar Publishing House, Anand, 1987.
6.	Rangwala .S.C,"*Valuation of Real Properties*", Charotar Publishing House,Anand, 1984.
7.	Jagannathan .G, "*Getting More at Less Cost*", - The Value Engineering Way, Tata McGraw Hill, New Delhi, 1992.
8.	Lecture notes on "*Development of Real Estate Business"*, Department of Civil Engineering, S.R.M. Engineering College, 2002

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage:		**50%**

15CE391L	**INDUSTRIAL TRAINING II** **(Training to be undergone after After Year III, Semester II)** **2 week practical training in industry**	**L**	**T**	**P**	**C**
		0	**0**	**1**	**1**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	To provide practical exposure in Civil Engineering related organizations								
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**							
At the end of the training, student will									
1.	Become aware of the practical applications of theoretical concepts studied in the class rooms after undergoing two – week practical training in Civil Engineering related organizations.	d	e	f	g	h	i	j	k

Description of course
Students have to undergo two-week practical training in Civil Engineering related organizations of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department. This course is mandatory and a student has to pass the course to become eligible for the award of degree.

Course nature	**PRACTICAL**
Assessment Method	
In-semester	**Assessment tool** The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations
	100%

15CE375L		MINOR PROJECT	L	T	P	C
			0	0	4	2

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To carry out a design project in one of the specializations of civil engineering with multidisciplinary component
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
After completing the minor project student will	
1. Be equipped to carry out the full fledged project work to be taken subsequently in VIII semester.	a-k

Description of course
The students will carry out a project in one of the following civil engineering areas but with multidisciplinary component involving other areasStructural EngineeringGeotechnical EngineeringWater Resources Engineering and environmental engg. Geomatics Engineering and surveying Construction managementTransportation engineering Student groups will be formed (Maximum: 6 in a group) and a faculty member will be allocated to guide them. The final year Major Project 15CE496L need not be a continuation of Minor Project.

Course nature			**PRACTICAL**
Assessment Method			
In-semester	**Assessment tool** There will be three reviews . First review will not carry any marks but the project topic will be finalized in it. Of remaining 2 reviews one will be carried out in the mid-semester and the last one by the end of semester. The break-up awarding internal assessment marks is given below:		

Marks	Awarded by	Criteria
30	**Guide**	**For regularity, systematic progress, extent of work and quality of w**
20	**Review committee during II review**	**Presentation, contents and viva**
20	**Review committee during III review**	**Quality of project report**
10	**Review committee during III review**	Multidisciplinary component
20	**Review committee during III review**	**Presentation, contents and viva**
100%		

15CE496L	**MAJOR PROJECT**	L	T	P	C
		0	0	24	12

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	The Major Project experience is the culminating academic endeavor of students who earn a degree in their Undergraduate Programs. The project provides students with the opportunity to explore a problem or issue of particular personal or professional interest and to address that problem or issue through focused study and applied research under the direction of a faculty member. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired in his/her academic program to real-world issues and problems. This final project affirms students' ability to think critically and creatively, to solve practical problems, to make reasoned and ethical decisions, and to communicate effectively.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**							
After completing the major project students will be able to									
1	Provide students with the opportunity to apply the knowledge and skills acquired in their courses to a specific problem or issue.	a	b	c	e	f			i
2	Extend their academic experience into areas of personal interest, working with new ideas, issues, organizations, and individuals.	a	c		e	f			i
3	Think critically and creatively about academic, professional, or social issues and to further develop their analytical and ethical leadership skills necessary to address and help solve these issues	a	c		e	f	h	i
4	refine research skills and demonstrate their proficiency in written and/or oral communication skills	a	c		e	f	g	i	j
5	Take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work			d				d	k

Session	**Description of course**	**Contact hours**	**C-D-I-O**	**IOs**	**Refer ence**
	1. The Major project is a major component of our engineering curriculum: it is the culmination of the program of study enabling the students to showcase the knowledge and the skills they have acquired during the previous four years, design a product/service of significance, and solve an open-ended problem in engineering. 2. Each student must register to the project course related to his or her program 3. Major Project course consists of one semester and would be allowed to register only during the final year of study. 4. The Major Project may be initiated during the pre-final semester but will be assessed and		C,D,I,O	1,2,3,4,5	

credits transferred only during the last semester of study, upon completion of all other degree requirements. Generally the undergraduate major project is a team based one.

5. Each team in the major project course will consist of maximum of 5 students.
6. Each project will be assigned a faculty, who will act as the supervisor.
7. The project shall be driven by realistic constraints like that related to economic, environmental, social, political, ethical, health & safety, manufacturability and sustainability.
8. Each group must document and implement a management structure. Group leadership roles must be clearly identified including who has responsibility for monitoring project deliverables and group coordination.
9. A group project may be interdisciplinary, with students enrolled in different engineering degrees, or in Engineering plus other faculties such as Management, Medical and Health Sciences, Science and Humanities.
10. Each student team is expected to maintain a log book that would normally be used to serve as a record of the way in which the project progressed during the course of the session.
11. Salient points discussed at meetings with the supervisor (i.e., suggestions for further meetings, changes to experimental procedures) should be recorded by the student in order to provide a basis for subsequent work.
12. The logbook may be formally assessed;
13. The contribution of each individual team member will be clearly identified and the weightage of this component will be explicitly considered while assessing the work done.
14. A project report is to be submitted on the topic which will be evaluated during the final review.
15. Assessment components will be as spelt out in the regulations.
16. The department will announce a marking scheme for awarding marks for the different sections of the report.

The project report must possess substantial technical depth and require the students to exercise analytical, evaluation and design skills at the appropriate level.

MAJOR PROJECT

Each project will cover all the aspects (to the extent possible) like investigation, planning, designing, detailing and estimating of a civil engineering structure / process in which the aspects like analysis, application of relevant codes, etc., will find a place. Alternately, a few research problems also may be identified for investigation and the use of laboratory facilities and appropriate design component shall be embedded in the work. The project shall be driven by realistic constraints like that related to economic, environmental, social, political, ethical, health & safety, manufacturability and sustainability. Each

project work will have multidisciplinary component either involving civil engineering areas other than that of the primary focus area of the project work under consideration or/ and components from other programs like Architecture, Mechanical Engineering etc.   The outcomes to be attained by students by doing the project work shall be spelt out clearly. A project report is to be submitted on the topic which will be evaluated during the final review. Major project work need not be a continuation of 15CE375L Minor Project

PRACTICE SCHOOL
Alternately, a student is encouraged to take an industrial project with civil engineering organizations or firms chosen by the institute. In such cases the student will stay with the firm and carry out the project. The project will be guided by the faculty member and the concerned officer in the industry. All the requirements spelt out under ' MAJOR PROJECT' above, shall be incorporated under this work also. However reviews will be conducted in the institute which the student shall attend.

Course nature			PRACTICAL		
Assessment Method					
In-semester	**Assessment tool**	Review I	Review II	Review III	Total
	Weightage	**10%**	**15%**	**20%**	**45%**
End semester	**Assessment tool**	**Project Report**	**Viva Voce**		**Total**
	Weightage	**25%**	**30%**		**55%**

ELECTIVE I

TRANSPORTATION ENGINEERING

OFFERED IN

III YEAR, II SEMESTER

15CE350E	RAILWAY, AIRPORT AND HARBOUR ENGINEERING		L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	15CE311					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE	TRANSPORTATION ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To impart the knowledge of planning, design, construction and maintenance of railway tracks, airports and harbours.				
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**			
At the end of the course, student will be able					
1.	To get exposed to Railway Planning and design	a	c		
2.	To understand the process of operation and maintenance of Railway track	a	e	k	
3.	To attain knowledge on the concepts of planning and design of airport components	a	c	k	
4.	To acquire knowledge about the various components of Harbour and docks	a	k		

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: RAILWAY PLANNING AND DESIGN	**9**			
1.	Introduction to railway engineering - Role of Indian Railways in National Development	1		1	1,6
2.	Track Alignment - Obligatory points - Engineering Surveys for Track Alignment – Conventional and Modern methods (Remote Sensing, GIS & GPS, EDM and other equipment)	2	C	1	1,6
3.	Permanent Way and its components – Functions of each component - Concept of Gauges - Coning of Wheels - Creeps and kinks	2	C	1	1,6
4.	Geometric Design of Railway Tracks – Gradients and Grade Compensation - Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves	4	C,D,I	1	1,6
	UNIT II: RAILWAY TRACK OPERATION AND MAINTENANCE	**9**			
5.	Points and Crossings - Turnouts – Types - Working Principle Signaling, Interlocking and Track Circuiting	2	C	2	1,6
6.	Construction & Maintenance – Conventional, Modern methods and Materials, Track Drainage	2	C	2	1,6
7.	Track Modernization– Automated maintenance and upgrading, Technologies, Re-laying of Track	2	C	2	1,6
8.	Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance, Level Crossings	3	C	2	1,6
	UNIT III: AIRPORT PLANNING AND GEOMETRIC DESIGN	**10**			
9.	Advantages and Limitations of Air Transport, Characteristics of Air travel	1	C	3	2,3,7

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
10.	Airport Master Plan – Evaluation and Institutional arrangements - Site Selection and survey, Components of airport	1	C	3	2,3,7
11.	Runway Design- Orientation, Cross wind Component, Wind rose Diagram (Problems)	2	C,I	3	2,3,7
12.	Basic Runway length and Corrections for Gradients (Problems), Airport classification, Geometric design and specifications, Runway patterns	3	C,I	3	2,3,7
13.	Taxiway Design – Geometric Design elements and specifications, Minimum Separation Distances, Airport Drainage Airport Zoning - Clearance over Highways and Railways	2	C	3	2,3,7
14.	Visual Aids – Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings	1	C	3	2,3,7
	UNIT IV: PAVEMENT DESIGN AND EVALUATION	**8**			
15.	Traffic component in pavement design	2	C,I	3	2,3,7
16.	Structural design of runway	2	C,D	3	2,3,7
17.	Pavement evaluation	2	C,O	3	
18.	Specification for airfield rigid pavement	2	C	3	2,3,7
	UNIT V: HARBOUR ENGINEERING	**9**			
19.	History and modern trends of waterway transportation, Definition of Terms - Harbours, Ports, Docks, Tides and Waves, Littoral Drift, Sounding, Classification of Harbours, Site Selection & harbour planning	3	C	4	4,5,8
20.	Types of Layouts of ports and components, Approach facilities	2	C	4	4,5,8
21.	Protection facilities – Breakwater and its types, Docking facilities – Wet docks – Dry docks and its types	2	C	4	4,5,8
22.	Loading facilities – Quay – Wharves – Piers – Jetties – Fendor - Dolphins, Storing facilities – Warehouses - Transit sheds – Cold storage, Navigation facilities – Light House-Signals, Dredging facilities	2	C	4	4,5,8
	Total contact hours			**45**	

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Saxena Subhash C and Satyapal Arora, "*A Course in Railway Engineering*", Dhanpat Rai and Sons, Delhi, 1998.
2.	Khanna S K, Arora M G and Jain S S, "*Airport Planning and Design*", Nemchand and Brothers, Roorkee, 1994.
3.	R Horonjeff and F X Mckelvy, Planning and design of Airport, Mc-Graw Hill International Editions, 1993
4.	S P Bindra, "*A Course in Docks and Harbour Engineering*", Dhanpat Rai and Sons, New Delhi, 1993.
5.	R. Srinivasan, "*Harbour, Docks and Tunnel Engineering*", Charotar Publishing home, 27th Edition, 2015
	REFERENCE BOOKS/OTHER READING MATERIAL
6.	S.C Rangwala, "*Railway Engineering*" , Charotar Publishing House, 1995
7.	S.C. Rangwala, "*Airport Engineering*" , Charotar Publishing House, 1996
8.	H. P. Oza and G H Oza, Dock and Harbour Engineering, Charotar Book House, 1996

Course nature				Theory			
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

	15CE351E	TRAFFIC ENGINEERING	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE311
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE TRANSPORTATION ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	The purpose of the course is to introduce the students on traffic flow modelling and design of various traffic regulatory and control measures.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES			
At the end of the course, student will be able					
1.	To know about traffic flow modelling.	a	b		
2.	To evaluate various transportation facilities.	c	h		
3.	To familiarize on various traffic regulatory measures.	c	e	h	
4.	To impart basic knowledge on the design of various traffic control measures.	c	e	h	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: TRAFFIC STREAM MODELLING	**10**			
1.	Introduction - Overview of syllabus	1		1-4	1,2,3,4
2.	Fundamental parameters - speed, density, volume, travel time, headway, spacing, time-space diagram	3	C	1	1,2
3.	Fundamental relations - time mean speed, space mean speed and their relation, relation between speeds, flow, density, fundamental diagrams	3	C	1	1,2
4.	Greenshield's model, Greenberg's logarithmic model, Underwood's exponential model, pipe's generalized model, multi-regime models, Moving observer method.	3	C	1	1,2,4
	UNIT II: MICROSCOPIC TRAFFIC FLOW MODELLING	**9**			
5.	Car-following models - Concept of stimulus-response, general motor's models	3	C	1	1,2
6.	Vehicle arrival models - Poisson distribution, headway modeling, random vehicle generation	3	C	1	1,3,5
7.	Microscopic traffic simulation - Vehicle generation, design, calibration, validation, applications, operational models.	3	C, I, O	1	1,3,5
	UNIT III: UNINTERRUPTED FLOW	**8**			
8.	Capacity and Level of service LOS - Definitions, highway capacity, factors affecting LOS	2	C	2	3,5,6
9.	HCM methods - Urban Street - Classification, operational performance measures, congestion management	2	C	2	3,5,6
10.	Multilane highways - Characteristics, capacity and level of service - Freeway operations	2	C, O	2	3,5,6
11.	Operational considerations, capacity and level of service of a basic freeway segment, weaving operation	2	C	2	6
	UNIT IV: INTERRUPTED FLOW	**9**			
12.	Traffic signs and road markings - Regulatory, warning, and information signs; longitudinal,	3	C	3	1,2,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	transverse, and object marking, channelization				
13.	Traffic rotary - Conflict resolution in a rotary, geometric layout, design elements, capacity of rotary	3	C, D	3	1,2,4
14.	Grade separated intersection - Road over bridges, under pass, overpass, trumpet interchange, diamond interchange, fully and partial clover leaf intersection.	3	C	3	1,2,4
	UNIT V: TRAFFIC CONTROL	**9**			
15.	Elements of traffic signal - Definitions, analysis of saturation headway, saturation flow, lost time, critical flows - Design principles of a traffic signal - Phase design, cycle time determination, green splitting	3	C, D	4	1,3
16.	Definitions and measurement of stopped and control delay, Webster's delay model - Capacity and LOS analysis - HCM 2000 method of analysis of a signalized intersection and determination of the level of service	3	C	4	1,3,6
17.	Coordinated traffic signal - Concepts of offset, common cycle length bandwidth, offset for one-way and two way streets - Vehicle actuated signals.	3	C	4	1,3
	Total contact hours	**45**			

	LEARNING RESOURCES		
Sl.No.	**TEXT BOOKS**		
1.	Roess, R. P. McShane, W. R. & Prassas, E. S. (1998), Traffic Engineering, Prentice – Hall.		
2.	May, A. D. (1990), "*Fundamentals of Traffic Flow*", second edn, Prentice Hall.		
3.	Papacostas, C. S. (1987), "*Fundamentals of Transportation Engineering*", Prentice-Hall, India		
4.	Kadiyali, L. R. (1987), "*Traffic Engineering and Transportation Planning*", Khanna Publishers, India.		
5.	Papacostas, C. S. and Prevedouros, P.D. (2001) "*Transportation Engineering and Planning*", Prentice Hall of India Pvt. Ltd.		
	REFERENCE BOOKS/OTHER READING MATERIAL		
6.	Highway Capacity Manual (2010), Transportation Research Board, USA		

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE352E		PAVEMENT ENGINEERING	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE311
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE TRANSPORTATION ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	This course is offered to develop skill on analysis and design of flexible pavements					
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**				
At the end of the course, student will be able						
1.	To familiarize with the analysis of layered structure	a	e	k		
2.	To know about viscoelastic characterization of the material	a	b	e	k	
3.	To impart basic knowledge on various bituminous technology and its characterization	a	b	i	k	
4.	To familiarize the design of flexible pavement	a	b	e	i	k
5.	To expose to the pavement condition evaluation process	a	e	i	k	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: STRESS ANALYSIS OF LAYERED STRUCTURE	**9**			
1	Importance of Pavement Design and Overview of the course	11	-	1	1,2,3,4
2	Single layer system – stress analysis	2	C, I	1	1,2,3,4
3	Two layer pavement - stress analysis	2	C, I	1	1,2,3,4
4	Multilayered stress analysis	2	C, I	1	1,2,3,4
5	Software demo for Multilayered structure	2	C, O	1	1
	UNIT II: VISCOELASTICITY	**9**			
6	Introduction to viscoelasticity – creep and recovery – stress relaxation	3	C	2	5
7	Response to oscillatory shearing	2	C	2	5
8	Viscoelastic solid model	2	C,D	2	5
9	Viscoelastic fluid model	2	C,D	2	5
	UNIT III: PAVEMENT MATERIALS	**9**			
10	Bitumen, modified bitumen, bitumen emulsion – performance grading of binder – aging of binder	3	C,O	3	1,2
11	Bituminous mixture - Hot mix, warm mix, half warm mix, cold mix	3	C,O	3	1,2
12	Mixture characterization – Resilient modulus - dynamic modulus – time temperature superposition principle	3	C, O	3	1,2
	UNIT IV: DESIGN OF FLEXIBLE PAVEMENT	**9**			
13	Traffic characteristics	3	C	4	2,3,6
14	Pavement Design as per IRC	3	C,D	4	2,3,6
15	Design of airfield pavement	3	C,D	4	2,3,6
	UNIT V: EVALUATION OF PAVEMENT	**9**			
16	Distress in flexible and rigid pavement	3	C	5	2,3
17	Pavement distress measurement – Surface roughness, skid resistance, deflection measurement and Falling weight deflectometer	4	C,O	5	2,3
18	Design of pavement overlay	2	C,D	5	2,3
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Yang Huang, Pavement Analysis and Design, Pearson, 2004
2.	Chakroborthy and A. Das, "*Principles of Transportation Engineering*", Prentice-Hall of India, 2003
3.	S. K. Khanna, C.E.G. Justo and A. Veeraragavan, "*Highway Engineering*", Revised 10th edition, Nem Chand &Bros., Roorkee, 2014.
4.	Yoder, E.J., and Witczak. "*Principles of Pavement Design*", 2nd ed. John Wiley and Sons, 1975.
5.	Wineman, A. S. and Rajagopal, K. R, "*Mechanical Response Of Polymers: An Introduction*", Cambridge University Press, 2000.
	REFERENCE BOOKS/OTHER READING MATERIAL
6.	Guidelines for the Design of Flexible Pavements, IRC :37- 2012, The Indian Road Congress, New Delhi, 2012
7.	Subash C. Saxena ,Textbook of "*Highway and Traffic Engineering*", CBS Publishers. 1st Edition. 2014

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

	15CE353E	PAVEMENT CONSTRUCTION TECHNOLOGY	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE311
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE TRANSPORTATION ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	The purpose of the course is to make student understand the importance of pavement construction technology and methods in the pavement construction process

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES	
At the end of the course, student will be able			
1.	To obtain information about pavement construction	a	k
2.	To attain knowledge about various pavement construction equipment	a	k
3.	To understand the construction procedures for various types of pavements	a	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: SUBGRADE CONSTRUCTION	**9**			
1.	Earthwork grading, compaction and construction of embankments and cuts - embankment construction on weak and compressible foundation, quality control tests	3	C	1	1
2.	Design factors, mix design, construction control and quality control checks for soil-cement, soil-bitumen and soil-lime stabilization methods.	4	C	1	1
3.	Principles of gradation/proportioning of soil-aggregate mixes and compaction	2	C	1	1,2
	UNIT II: CONSTRUCTION OF FLEXIBLE PAVEMENT	**9**			
4.	Methods of construction and field control checks for various types of flexible pavement layers in in sub-base, base, binder and surface course layers	4	C	3	1,3
5.	Need for recycling, methods of recycling, construction controls and economics.	3	C	3	1,3
6.	Warm mix and cold mix asphalt pavement	2	C	3	1,3
	UNIT III: CONSTRUCTION OF RIGID PAVEMENT	**9**			
7.	Concrete mix design procedure	2	C,D	3	1,4
8.	Methods and guideline for construction for concrete pavement	3	C	3	1,4
9.	Construction of supporting layers of CC pavement, pavement slab, joints in pavements and its quality control check during construction	2	C	3	1,4
10.	Construction practice of brick, stone and concrete block pavement	2	C	3	4
	UNIT IV: PAVEMENT CONSTRUCTION EQUIPMENT	**9**			
11.	Equipment for excavation, grading and compaction -their working principle,	3	C	2	1,2,6

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	advantages and limitations.				
12.	Special equipment for bituminous road construction	3	C	2	2,6
13.	Special equipment for cement concrete pavement construction	3	C	2	2,6
	UNIT V: PAVEMENT CONSTRUCTION – SPECIAL CASES	**9**			
14.	General guidelines for construction of pavement in water logged areas as per IRC specifications	2	C	3	1,2
15.	Design and construction of surface and sub-surface drainage system for highways and airports. Drainage materials, design procedures and IRC Guidelines for Drainage of Urban Roads	4	C	3	1,2
16. .	Functions and applications of Geosynthetics in highway embankment, slopes, new pavements and overlays	3	C	3	1,2
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	S. K. Khanna, C.E.G. Justo and A. Veeraragavan, "*Highway Engineering*", Revised 10th edition, Nem Chand &Bros., Roorkee, 2014.
2.	Sharma, S.C."*Construction Equipment and its Management*"- Khanna Publisher
3.	Freddy L. Roberts, Prithvi S. Khandal, E. Ray Brown, Dah-Yinn Lee and Thomas W. Kenneday, Hot Mix Asphalt Materials, Mixture, Design and Construction, NAPA Education Foundation, 1997
4.	Norbert J. Delatte, ' *Concrete Pavement Design, Construction and Performance*', Second Edition, CRC Press, 2014
	REFERENCE BOOKS/OTHER READING MATERIAL
5.	Kadyali L.R and Lal N.B, " *Principles and practices of Highway Engineering (Including Expressways and Airport Engineering)*" , Khanna publishers, Delhi
6.	Peurify.R.L., "*Construction Planning, Equipment and Methods*", McGraw Hill Publishers, New York, 2000.
7.	Relevant IRC code books

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

	15CE354E	**PAVEMENT MANAGEMENT SYSTEM**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Co-requisite:	NIL			
Prerequisite:	15CE311			
Data Book / Codes/Standards	NIL			
Course Category	P	PROFESSIONAL ELECTIVE	TRANSPORTATION ENGINEERING	
Course designed by	Department of Civil Engineering			
Approval	32nd Academic Council Meeting , 2016			

PURPOSE	The purpose of the course is to make student understand the importance of pavement asset management				
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**			
At the end of the course, student will be able					
1.	To understand the various levels in pavement management	a	e	k	
2.	To study various pavement evaluation technique and understand the data requirement for effective management	a	e	i	k
3.	To select suitable rehabilitation strategies	a	e	k	
4.	To conduct economic analysis of different strategies	a	e	k	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: PAVEMENT MANAGEMENT PROCESS	**9**			
1.	Need for Pavement Management and its Concept	2	C	1	1,2
2.	Different levels of pavement management and functions	3	C	1	1,2
3.	Applications of Pavement Management System as a planning and technology improvement tool	4	C	1	1,2
	UNIT II: DATA REQUIREMENT	**10**			
4.	Overview of pavement management data needs, inventory data	2	C	2	1,2
5.	Characterizing pavement performance, evaluation of pavement structural capacity, evaluation of pavement surface distress condition, evaluation of pavement safety	5	C,I	2	1,2,4
6.	Combined measures of pavement quality, data base management, communicating the present status of pavement networks	3	C	2	1,2
	UNIT III: PRIORITY OF REHABILITATION AND MAINTENANCE	**9**			
7.	Establishing criteria for rehabilitation	1		3	1,2,3
8.	Prediction models for pavement deterioration, Rehabilitation and maintenance alternatives	4	C	3	1,2,3
9.	Priority programming of rehabilitation and maintenance, developing combined programs of maintenance and rehabilitation	4	C	3	1,2,3
	UNIT IV: REHABILITATION DESIGN AND ECONOMIC ANALYSIS	**9**			
10.	Generating alternate strategies of design and rehabilitation - Materials, construction and maintenance policy alternatives	3	C	3	1,2,4
11.	Consideration of preservation in pavement design and analysis procedures	3	C	4	1,2,4
12.	Economic evaluation of alternate pavement design strategies and selection of optimal strategies	3	C,I	4	1,2,4
	UNIT V: INNOVATIONS IN PAVEMENT	**8**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	MANAGEMENT				
13.	Role of construction quality on performance and pavement preservation on maintenance needs	2	C	2,3	1,3,5
14.	Emerging trends in road asset management	3	C	2,3	1,3,5
15.	Urban Pavement Management System	3	C	2,3	1,3,5
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Ralph Haas, W. Ronald Hudson, "*Pavement Asset Management*", John Wiley & Sons, 2015
2.	Ralph C, G Haas and W. Ronald Hudson, "*Pavement management system*", McGraw-Hill Book Company, 1978
3.	W. Ronald Hudson, Ralph Haas and Zeniswki , "*Modern Pavement Management*", Krieger Pub. Co., 1994
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	RajibBasuMallick and Tahar El-Kochi, Pavement Engineering: Principles and Practice, CRC Press, 2013.
5.	Shahin, M.Y, Pavement Management for Airports, Roads and Parking Lots, Springer, Second Edition, 2005.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE355E		TRANSPORTATION SYSTEMS PLANNING	L	T	P	C
			3	0	0	3

Co-requisite:	NIL			
Prerequisite:	15CE311			
Data Book / Codes/Standards	NIL			
Course Category	P	PROFESSIONAL ELECTIVE	TRANSPORTATION ENGINEERING	
Course designed by	Department of Civil Engineering			
Approval	32nd Academic Council Meeting , 2016			

PURPOSE	The purpose of the course is to introduce the students on planning of various urban transportation facilities.				
INSTRUCTIONAL OBJECTIVES			**STUDENT OUTCOMES**		
At the end of the course, student will be able					
1.	To know about transportation system characteristics and planning process.	a			
2.	To familiarize on various travel surveys and data collection techniques.	a	b		
3.	To impart basic knowledge on travel demand forecasting	a	b	e	
4.	To enable the evaluation of various transportation projects.	a	b	e	h

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: URBAN TRANSPORTATION PROBLEM	**10**			
1.	Introduction - Overview of syllabus	1	C	1-4	1,2,3,4,5
2.	Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach	3	C	1	1,2,4
3.	Travel demand - Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables	3	C	1	1,2,4
4.	Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.	3	C	1	1,2,4
	UNIT II: DATA COLLECTION AND INVENTORIES	**9**			
5.	Collection of data – Organization of surveys and Analysis, Study Area, Zoning, Types and Sources of Data	3	C	2	1,2
6.	Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors	3	C	2	1,2
7.	Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.	3	C	2	1,2
	UNIT III: TRIP GENERATION AND DISTRIBUTION	**9**			
8.	UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models	3	C	3	3,4
9.	Trip Attraction models, Commercial Trip Rates - Trip Distribution - Growth Factor Methods	3	C	3	3,4
10.	Gravity Models, Opportunity Models, Time Function Iteration Models.	3	C	3	3,4
	UNIT IV: MODE CHOICE AND TRAFFIC ASSIGNMENT	**9**			
11.	Mode Choice Analysis: Mode Choice Behavior,	3	C	3	3,4

	Competing Modes, Mode Split Curves, Models and Probabilistic Approaches.				
12.	Traffic Assignment: Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree	3	C	3	3,4
13.	All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment, Diversion Curves.	3	C	3	3,4
	UNIT V: TRAFFIC CORRIDORS AND PLAN PREPARATION	**8**			
14.	Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis	3	C	4	1,4,5
15.	Plan preparation and evaluation - Travel Forecasts to Evaluate Alternative Improvements	2	C	4	1,4,5
16.	Brief Case studies of Comprehensive Traffic and Transportation problems of Indian towns / cities, Introduction to Computer packages	3	C, D	4	1,4,5
	Total contact hours			45	

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Bruton, M. J. (2000), "*An Introduction to Transportation Planning*" (The Living Environment), UCL Press, London, UK.
2.	Hutchinson, B.G. (1974), "*Principles of Urban Transportation System Planning*", McGraw Hill.
3.	Papacostas, C.S. and Prevedouros, P.D. (2001), "*Transportation Engineering and Planning*", Prentice Hall of India Pvt. Ltd.
4.	Mayer M and Miller E (2000), "*Urban Transportation Planning: A decision oriented Approach*", McGraw Hill.
	REFERENCE BOOKS/OTHER READING MATERIAL
5.	Edwards, J. D. (1999), Transportation Planning Handbook, 2nd Edition, Institution of Transportation Engineers.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE356E		INTELLIGENT TRANSPORTATION SYSTEMS	L	T	P	C
			3	0	0	3

Co-requisite:	NIL			
Prerequisite:	15CE311			
Data Book / Codes/Standards	NIL			
Course Category	P	PROFESSIONAL ELECTIVE	TRANSPORTATION ENGINEERING	
Course designed by	Department of Civil Engineering			
Approval	32nd Academic Council Meeting , 2016			

PURPOSE	This course imparts knowledge on various ITS technology and at the end of the course student will be able to appreciate the effectiveness of ITS tool.			
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able				
1.	To know about the fundamentals of ITS and its features	a	k	
2.	To gain knowledge on the importance of telecommunication and data collection of ITS	a	c	d
3.	To learn the various functional areas of ITS	a	d	
4.	To study the implementation of ITS for the various user needs and services	a	d	k
5.	To know about the ITS applications globally	a	d	i

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT – 1 FUNDAMENTALS OF ITS	**7**			
1.	Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS	7	C	1	1,5
	UNIT – II TELECOMMUNICATIONS AND DATA REQUIREMENTS OF ITS	**11**			
2.	Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC).	2	C	2	1,2
3.	Application of sensors to Traffic management; Traffic flow sensor technologies	3	C,I	2	1,2
4.	ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.	4	C,I	1	1,2
5.	Vehicle – Road side communication – Vehicle Positioning System	2	C	2	1,2
	UNIT – III ITS FUNCTIONAL AREAS	**9**			
6.	Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS)	3	C	3	1,2
7.	Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS)	3	C	3	1,2
8.	Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS)	3	C	3	1,2
	UNIT – IV ITS USER NEEDS AND SERVICES	**9**			
9.	Travel and Traffic management, Public Transportation Management, Electronic Payment	3	C	4	2,3
10.	Commercial Vehicle Operations, Emergency Management	3	C	4	2,3
11.	Advanced Vehicle safety systems, Information Management	3	C	4	2,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT – V ITS APPLICATIONS	**9**			
12.	Automated Highway Systems - Vehicles in Platoons	3	C,I	5	5,3
13.	Integration of Automated Highway Systems – A case study	3	C,I	5	
14.	ITS Programs globaly – Overview of ITS implementations in developed countries, ITS in developing countries	3	C,I	5	5,3
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	"*Fundamentals of intelligent transportation systems planning*" Mashrur A. Chowdhury, Adel Wadid Sadek
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Lawrence A. Klein ," *Sensor technologies and Data requirements of ITS*"
3.	"*Recommendations for World Road Association (PIARC)*" Kan Paul Chen, John Miles , ITS Hand Book 2000
4.	Sussman, J. M., "*Perspective on ITS*", Artech House Publishers, 2005.
5.	"*National ITS Architecture Documentation*", US Department of Transportation, 2007

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE357E	URBAN PLANNING AND SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

Co-requisite:	NIL		
Prerequisite:	15CE311		
Data Book / Codes/Standards	NIL		
Course Category	P	PROFESSIONAL ELECTIVE	TRANSPORTATION ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	This course is offered to gain a knowledge about transportation policies and their planning and to know about the urban planning and sustainable development

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To know about urban planning and their development.	a		d	f	h	k	i	
2.	To know about various development plans, formulation and evaluation	a			f	h	i		
3.	To familiarize with plan implementation and urban management	f				h	k		
4.	To know sustainable urban and Transport principles	a				h	i		
5.	To familiarize about urban region and their environment	f				h	k	i	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: URBAN PLANNING AND DEVELOPMENT	**10**			
1	Overview of the course	1			1,3,4,5
2	Introduction – Definition of terms	1	C	1	1,3
3	National policies and strategies on issues related to urban development – Explanation of Concepts	2	C,I	1	1,3
4	Trends of Urbanization – Positive and Negative impacts of Urban development	2	C	1	1,3
5	Types and levels of Urban plans	2	C	1	1,3
6	Stages in planning process	1	C,I	1	1,3
7	Principles of planning	1	C,I	1	1,3
	UNIT II: DEVELOPMENT PLANS, FORMULATION AND EVALUATION	**9**			
8	Scope and content of regional plan and Master plan	2	C	2	1,2,3
9	Detailed development plan, Structural plan	2	C,I	2	1,2,3
10	Sub regional plan, DCR planning and development of industrial estates	2	C,I	2	1,2,3
11	SEZ – Strategies of development – formulation and evaluation	3	C,I,O	2	1,2,3
	UNIT III: PLAN IMPLEMENTATION AND URBAN MANAGEMENT	**9**			
12	Constraints of plan implementation – Industrial, Financial and Legal constraints	3	C,I	3	1,3,5
13	Institutional arrangements for urban development	2	C,I	3	1,3,5
14	Financing of urban developments	1	C,I	3	1,3,5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
15	Decision support for Urban Management- Involvement of public, Private, NGO, CBO - Beneficiaries	3	C,I,O	3	1,3,5
	UNIT IV: SYSTAINABLE URBAN AND TRANSPORT PRINCIPLES	**9**			
16	Urban Environmental Sustainability	1	C	4	1,3,5
17	Urban Sustainable development	2	C	4	1,3,5
18	Methods and Tools for Sustainable appraisal	2	C,I	4	1,3
19	Sustainable Transportation – Principles, indicators and its implication	2	C,I	4	4,5
20	Environment and resources – Economic benefits of Sustainable transportation	2	C,I	4	4,5
	UNIT V: URBAN REGION AND ENVIRONMENT	**8**			
21	Sustainability Assessment – Future scenarios	2	C	5	3,5
22	Shape of urban region, Managing the change, Integrated planning	2	C	5	3.5
23	Sustainable development - city centre areas, Inner city areas, suburban areas, periurban areas, country side	2	C,I	5	2,3,5
24	Economy and society	2	C,I	5	3,5
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Goel.S.L "*Urban development and Mangement*", Deep publication , New Delhi, 2002
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	CMDA, Master plan for Chennai, 2008
3.	Sigh.V,B, "*Revitalised urban administration in India*", Kalpaz publication, Delhi 2001
4.	"*Sustainable Transportation and TDM – planning the balances , Economic , Social and ecological Objectives",* Victoria transport policy institute, 2007
5.	Joe Ravetz, City region 2020 – "*Integrated planning for a sustainable Environment*", 2000.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

ELECTIVE II

WATER RESOURCES ENGINEERING

OFFERED IN

IV YEAR, I SEMESTER

15CE421E		ADVANCED HYDROLOGY	L	T	P	C
			3	0	0	3

Co-requisite:	NIL					
Prerequisite:	15CE304					
Data Book / Codes/Standards	NIL					
Course Category	E	PROFESSIONAL ELECTIVE	WATER RESOURCES ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of Engineering.					
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**				
At the end of the course, student will be able						
1.	To know the basic concepts of hydrology	a				
2.	To study the features of precipitation, rain gauge density, DAD curve, evaporation, transpiration and infiltration,	a	b	c	h	k	
3.	To learn about runoff, estimation, modeling of runoff, and hydrograph.	a		c	h	k	e
4.	To understand estimation, forecasting, control of flood, and concept of Muskingum method.	a	-	c	h	k	e
5.	To familiarize with computer applications in hydrology using artificial neural network, fuzzy logic	a	-	c	h	k	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: HYDROLOGY	**7**			
1.	Introduction about Hydrology	1	C	1-5	1,2
2.	Hydrology and hydrologic cycle	1	C	1	1,2
3.	World's water resources and India's water resources	2	C	1	1,2,3,4
4.	Hydrologic budget , problems based on water budget, Hydrometeorology	3	C,I	1	2,3
	UNIT II: PRECIPITATION, EVAPORATION AND INFILTRATION	**11**			
5.	Precipitation, Types, Measurement, Types, Rain gauge density	2	C,I	2	2,3,5
6.	Estimation of missing data, Optimum rain gauge network, Problems solving	2	C,I	2	1,2
7.	DAD curves, Analysis of rainfall data, Evaporation, Transpiration	2	C,I	2	2,3,4
8.	Evaporation, Factors affecting evaporation, Measurement and Estimation	1	C	2	1,2
9.	Transpiration, Measurement and estimation, Pan evaporation, Blaney Criddle method	2	C,I	2	3,4,5
10.	Infiltration, Factors affecting infiltration, Measurement and estimation Horton's model, Phi-index, W-index	2	C,I	2	1,2
	UNIT III: RUNOFF AND HYDROGRAPHS	**9**			
11.	Runoff, Components of stream flow, Catchment characteristics	2	C	3	3,4
12.	Factors affecting runoff, Estimation of runoff, Different Methods, Flow duration curve	2	C,I	3	3,4
13.	Rainfall runoff modeling, Hydrograph, Unit hydrograph, problems	3	C	3	3,4
14.	S- curve hydrograph, Synthetic hydrograph, Applications	2	C,I	3	1,2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT IV: FLOOD ESTIMATION AND FORECASTING	**10**			
15.	Estimation of peak flood, Flood frequency studies, Gumbel's method	3	C,I	4	2,3,5
16.	Methods of flood control, Flood routing through a reservoir	3	C,I	4	3,4,5
17.	Channel flow routing	1	C,I	4	1,2
18.	Muskingum method, Flood forecasting and warning	3	C,I	4	1,2,3
	UNIT V: RESERVOIR PLANNING AND MANAGEMENT	**8**			
19.	Reservoir , Single and multipurpose, Multi objective	2	C	5	1,2,3
20.	Fixation of storage capacity, Strategies for reservoir operation	2	C,I	5	2,3,5
21.	Sedimentation of reservoirs, Design flood	2	C,I	5	3,4,5
22.	Levees and flood walls, Channel improvement	2	C,I	5	3,4,5
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Raghunath, H.M, " *Hydrology: Principles, Analysis and Design* ", New age publications, 2006
2.	K. Subramanya " *Engineering Hydrology*" Tata McGraw- Hill Education,
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Chow V T and Maidment, "*Hydrology for Engineers*", McGraw Hill Inc , Ltd., 2000
4.	Singh V P, "*Hydrology*", McGraw Hill Inc., Ltd., 2000
5.	Vedula S. and Mujumdar P.P, " *Water Resources Systems*", Mcgraw Hill International Book Company, 2005
6.	http://www.nptel.ac.in/courses/105101002/

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination weightage :		**50%**

15CE422E	ADVANCED IRRIGATION ENGINEERING DESIGN	L	T	P	C
		3	0	0	3

Co-requisite:	NIL		
Prerequisite:	15CE304		
Data Book / Codes/Standards	NIL		
Course Category	E	PROFESSIONAL ELECTIVE	WATER RESOURCES ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of Engineering.			
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able				
1.	To know the basics of irrigation, types and methods, drip, sprinkler and lift irrigation.	a		
2.	To study the relationship between soil, plant and water, duty and delta relationship and consumptive use	a	e	
3.	To learn about importance and functions of diversion head works and its various components	a	e	
4.	To learn about importance, location and function of conveyance and distribution system	a	e	
5.	To learn about importance, location and function of various canal structures such as canal fall, canal regulators, cross regulators etc.	a	f	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: IRRIGATION	**8**			
1.	Introduction - overview of syllabus	1	C	1-4	1-4
2.	Necessity and importance of irrigation - Advantages and ill effects of irrigation – Types of irrigation	2	C	1	1, 2, 3, 4
3.	Irrigation methods – Types of Surface, subsurface and sprinkler irrigation	2	C	1	1, 2, 3, 4
4.	Pressurized irrigation - Drip, Sprinkler, Lift Irrigation	2	C	1	1, 2, 3, 4
5.	Methods of improving soil fertility – Standards of quality for irrigation water	1	C	1	1, 2, 3, 4
	UNIT II: WATER REQUIREMENTS OF CROPS	**8**			
6.	Preparation of land for irrigation – Classes and availability of soil water – Soil moisture deficiency – Depth of water stored in root zone - Limiting soil moisture conditions – Depth and Frequency of irrigation	2	C, I	2	1, 2, 3, 4
7.	Crop season - Duty and Delta – Factors affecting duty – Methods of improving duty	2	C, I	2	1, 2, 3, 4
8.	Consumptive use - Estimation - Blaney Criddle method - Pan evaporation method	2	C, I	2	1, 2, 3, 4
9.	Irrigation efficiencies – Types – Principle crops and Crop rotation – Assessment of irrigation water	2	C, I	2	1, 2, 3, 4
	UNIT III: DIVERSION HEAD WORKS	**11**			
10.	Weirs and barrages – Gravity and non-gravity	2	C	3	1, 2, 3, 4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	weirs – Diversion head works and its components				
11.	Diversion weir and its types – Afflux, pond level – Under sluices – Divide wall – River training works – Guide banks, Marginal bunds, Groynes – Fish ladder	2	C	3	1, 2, 3, 4
12.	Canal head regulator – functions – Design of water way of regulator	2	C,D	3	1, 2, 3, 4
13.	Silt control devices – Silt excluders and Silt ejectors	1	C	3	1, 2, 3, 4
14.	Failure of hydraulic structures – Failure by piping and failure by direct uplift, Bligh's creep theory, Lane's weighted creep theory and Khosla's theory	2	C,I	3	1, 2, 3, 4
15.	Khosla's method of independent variables for determination of pressures and exit gradient for seepage below a weir or a barrage. Design of a vertical drop weir on Bligh's creep theory. Design of pucca floor and aprons.	2	C,D	3	1, 2, 3, 4
	UNIT IV: CONVEYANCE AND DISTRIBUTION SYSTEM	**9**			
16.	Canal – Classification –Canal alignment - Canal losses – Balancing depth	1	C	4	1, 2, 3, 4
17.	Maintenance of irrigation channels – Canal breaches – Regulation of canal system	2	C	4	1, 2, 3, 4
18.	Measurement of discharge of a canal – Area velocity method, Chemical method, Weir method, Meter flume method, Stage discharge method	2	C, I	4	1, 2, 3, 4
19.	Water logging – Causes and control – Reclamation of saline land - Land drainage – types – Layout of tile drain system	2	C, I	4	1, 2, 3, 4
20.	Canal lining – Advantages and Disadvantages of canal lining – Type of lining	2	C	4	1, 2, 3, 4
	UNIT V: CANAL STRUCTURES	**9**			
21.	Canal falls – Necessity and location of falls – Types – Design of a trapezoidal notch fall – Design of simple vertical drop fall	3	C,D	5	1, 2, 3, 4
22.	Canal regulators – Alignment of the off taking channel - Head and cross regulators – Functions - Design	2	C,D	5	1, 2, 3, 4
23.	Canal escape – Types - Canal outlets – Types	2	C,D	5	1, 2, 3, 4
24.	Cross drainage works – Types – Selection of suitable type of cross drainage work	2	C	5	1, 2, 3, 4
Total contact hours		**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Santhosh Kumar Garg, *"Irrigation Engineering and Hydraulic Structures"*, Khanna Publishers, 2000.
2.	Punmia B.C. and Pande B.B. Lal, " *Irrigation and Water Power Engineering"*, Laxmi Publications Pvt. Ltd., New Delhi, 2009
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Asawa .G.L, *"Irrigation and Water Resources Engineering"*, New Age International Publishers, New Delhi, 2005.
4.	Sharma .R.K, *"Irrigation Engineering and Hydraulic Structures"*, Oxford and IBH Publishing Company, New Delhi, 2002.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE423E		**GROUNDWATER ENGINEERING**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Co-requisite:	NIL
Prerequisite:	15CE304
Data Book / Codes/Standards	NIL
Course Category	E PROFESSIONAL ELECTIVE WATER RESOURCES ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting 2016

PURPOSE	The purpose of this course is to understand the principles and application of ground water engineering.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**			
At the end of the course, student will be able					
1.	To understand the sources of ground water, aquifers, water occurrence in different types of rocks.	a	e		
2.	To understand the ground water potential theory and movement of ground water through Theis' method and Jacob's method.	a	e		
3.	To study about open well and tube well.	a	c	e	
4.	To study the evaluation of aquifer parameters through pumping test, recuperation test and methods of ground water investigation.	a	e		
5.	To study the ground water contamination and recharge methods.	a	h	k	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I – GEOHYDROLOGY	**7**			
1.	Introduction, Water bearing formations-Aquifer, Aquitard, aquiclude, Aquifuge, Geological formation of water supply, Subsurface distribution of water, Sources of ground water	3	C	1	1,3,4
2.	Types of aquifers-Confined , Unconfined, Leaky and Perched Aquifers, Aquifer parameters-Porosity, Hydraulic Conductivity, Specific Yield, Storage Coefficient and Transmissivity, Groundwater in different rocks.	4	C,I	1	1,3,4
	UNIT II – GROUNDWATER MOVEMENT	**14**			
3.	Groundwater flow-Darcy's law- Permeability-Ground water flow problems i) Steady state 1D flow, ii) Aquifer with recharge, iii) Steady state flow confined aquifer with constant and Variable thickness	6	C	2	1,3,4
4.	Steady state flow- Dupit's Equation and Thiem's Equation	4	C,I	2	1,3,4
5.	Unsteady flow- Theis method and Jacob's method	4	C,I	2	1,3,4
	UNIT III – WELLS AND EXPLORATION	**8**			
6.	Open wells-Types, Construction of open wells, Pumping Test, Recuperation Test, Image well Theory.	4	C	3	1,3,4
7.	Tube well-Types-Construction and boring of tube well	3	C	3	1,3,4
8.	Well capacity, Well development	1	C	3	1,3,4
	UNIT IV – GROUND WATER GEOPHYSICS	**8**			
9.	Groundwater investigation, Geological methods,	4	C	4	1,3,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
10.	Geophysical- Electrical Resistivity Methods, Seismic Refraction methods, Hydrological Maps, Remote sensing methods.	4	C	4	1,3,4
	UNIT V – ENVIRONMENTAL GROUNDWATER	**8**			
11.	Groundwater quality- Groundwater contamination,	1	C	5	2,3,4
12.	Seawater intrusion-Fresh Water Salt Water Interface, Slope of Interface shape of Interface, Control measures	3	C	5	2,3,4
13.	Groundwater Development, Conjunctive Use, Groundwater recharge, Recharge methods	2	C	5	2,3,4
14.	Groundwater modeling-Conceptual Model, Physical Model, Analog Model, Mathematical Model	2	C,I,O	5	2,3,4
	Total contact hours	**45**			

	LEARNING RESOURCES				
Sl. No.	**TEXT BOOKS**				
1.	Raghunath .H.M, "*Ground Water Hydrology*", Wiley Eastern Ltd., Second reprint, 2000.				
	REFERENCE BOOKS/OTHER READING MATERIAL				
2.	David Keith Todd, Larry W.Mays, *"Groundwater Hydrology"*, John Wiley and Sons, 2004.				
3.	Murthy .V.V.N, *"Land and Water Management Engineering"*, Kalyani Publishers, New Delhi, 1994.				
4.	http://nptel.ac.in/courses/105105042/				
5.	http://nptel.ac.in/courses/105103026/				

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE424E		COASTAL ENGINEERING AND MANAGEMENT		L	T	P	C
				3	0	0	3

Co-requisite:	NIL		
Prerequisite:	NIL		
Data Book / Codes/Standards	NIL		
Course Category	E	PROFESSIONAL ELECTIVE	WATER RESOURCES ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	The purpose of this course is to learn about the coastal features and to obtain knowledge about managing the coastal zone		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able			
1.	To learn about estuaries, wetlands, lagoons, and of the uses of and stresses on the coastal zone.	a	
2.	To study the classification, characteristics, and theories of waves, tides and currents.	a	
3.	To learn about coastal erosion, sea level change, and coastal structures.	a	h
4.	To study sea water intrusion, desalination, and anthropogenic impacts on wetlands, mangroves and coral reefs.	a	h
5.	To learn about coastal zone management and the applications of remote sensing and geographical information systems in coastal zone management.	a	h

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I -COASTAL FEATURES	**9**			
1.	Basic Concepts - Coastal Waters, Estuaries, Wetlands and Lagoons	1	C	1	1-3
2.	Pollution Stresses on Coastal Waters	1	C	1	1-3
3.	Beaches - Types of Beaches - Beach Profiles – Long shore Drift	2	C	1	1-3
4.	Marine Sediments -Sediment Transport, Texture, Composition and Distribution	2	C	1	1-3
5.	Resources in the Coastal Zone and their Conservation and Utilization	2	C	1	1-3
6.	Non-living Resources and their Exploration and Exploitation	1	C	1	1-3
	UNIT II – WAVES, TIDES AND CURRENTS	**9**			
7.	Waves – Classification and characteristics	2	C	2	1-3
8.	Wave theories - Wave energy - Wave deformation	3	C	2	1-3
9.	Breaking of waves - Wave forecasting -Tides – Classification – Harmonics	3	C	2	1-3
10.	Currents - Classification of Currents	1	C	2	1-3
	UNIT III – COASTAL PROCESSES AND MANMADE STRUCTURES	**9**			
11.	Plate Tectonics and Coasts - Types of Coasts	2	C	3	1-3
12.	Coastal Erosion - Causes, Effects and Protection	1	C	3	1-3
13.	Sea Level Change - Coastal Structures	2	C	3	1-3
14.	Soft and hard engineering structures	2	C	3	1-3
15.	Wave Force on Structures.	2	C	3	1-3
	UNIT IV – ENVIRONMENTAL IMPACTS IN COASTAL ZONE	**9**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
16.	Land Use in Coastal Zone - Seawater Intrusion	3	C	4	1-3
17.	Desalination - Brackish Water Aquaculture and its Impact on Coastal Zone	3	C	4	1-3
18.	Natural Hazards in Coastal Zone – Impacts on wetlands, mangroves and coral reefs.	3	C	4	1-3
	UNIT V – COASTAL ZONE MANAGEMENT AND RS & GIS APPLICATIONS	**9**			
19.	Coastal Zone Management - Concepts and Development	2	C	5	1-3
20.	Database for Coastal Zone Management	2	C	5	1-3
21.	Remote Sensing Data for CZM	2	C	5	1-3
22.	GIS - Concepts and Models Used in Coastal Zone-Case studies	3	C	5	1-3
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Garrison.T, *"Oceanography"*, Wadsworth Publications, 4th edition, 2002
2.	Sorenson.R. M, *"Coastal Zone Engineering"*, Chapman & Hall, 3rd edition, 2006
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Shore protection manual ,Volume I, coastal engineering research centre, Department of army, US army engineer waterways experiment station 1984.

Course nature							Theory	
Assessment Method (Weightage 100%)								
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**	
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**	
						End semester examination Weightage :		**50%**

15CE426E		**HYDROPOWER ENGINEERING**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	15CE208					
Data Book / Codes/Standards	NIL					
Course Category	E	PROFESSIONAL ELECTIVE	WATER RESOURCES ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	The purpose of this course is to understand the concept of hydropower projects including investigation, planning and design aspects.				
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**			
At the end of the course, student will be able					
1.	To learn the elements of hydropower scheme.	a	h	k	
2.	To study the estimation of hydropower potential.	a	e	k	
3.	To gain knowledge on water conveyance system by studying intake structures, power canals, surge tanks and penstocks.	a	c	e	k
4.	To understand the force exerted by a jet on a fixed target, moving target, and by a jet on a series of curved vanes.	a	e	k	
5.	To gain knowledge on Francis turbine and Miscellaneous hydraulic machines.	a	c	e	k

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I – HYDROPOWER PLANT DEVELOPMENT	**7**			
1.	Sources and forms of energy	1	C	1	1,4
2.	Hydropower plants classification	1	C	1	1,4
3.	Layout and components, Development of hydropower schemes	3	C	1	1,4
4.	Comparison of Hydro and Thermal power, Survey and Investigation	2	C	1	1,4
	UNIT II – POWER POTENTIAL	**8**			
5.	Estimation of Hydropower potential	2	C,I	2	1,4
6.	Flow duration curve, Firm power, Secondary power	2	C,I	2	1,4
7.	Load and Load duration curves, Load factor, Firm capacity,	2	C,I	2	1,4
8.	Reservoir capacity, Capacity factor	2	C,I	2	1,4
	UNIT III – WATER CONVEYANCE SYSTEM	**12**			
9.	Intake structures: Location function and types of intakes, Energy losses at intake trash rock	2	C	3	1,4
10.	Power canals , Alignment, Design of power canals	2	C,D	3	1,4
11.	Penstocks, Alignment, types of penstock, Economic diameter of penstocks and Anchor blocks	3	C,I	3	1,4
12.	Water hammer pressure	1	C	3	1,4
13.	Behavior of surge tanks, Types of surge tanks	2	C	3	1,4
14.	Hydraulic design of simple surge tank	2	C,D	3	1,4
	UNIT IV – IMPACT OF JET ON VANES	**9**			
15.	Introduction to Impulse	1	C	4	1,2,3
16.	Momentum equation and its applications	2	C	4	1,2,3
17.	Force exerted by a Jet on a fixed target	2	C,I	4	1,2,3
18.	Force exerted by a Jet on a moving target	2	C,I	4	1,2,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
19.	Force exerted by a Jet on a serious of curved vane	2	C,I	4	1,2,3
	UNIT V – MISCELLANEOUS HYDRAULIC MACHINES	**9**			
20.	Francis Turbine , Component and Working	1	C,O	5	1,2,3
21.	Velocity triangle, Work done	1	C	5	1,2,3
22.	Design parameters, Problems	2	C,D,I	5	1,2,3
23.	Draft tube theory, Runaway speed	1	C	5	1,2,3
24.	Hydraulic accumulator, Hydraulic intensifier	2	C	5	1,2,3
25.	Hydraulic press and ram, Hydraulic cranes and lift	2	C	5	1,2,3
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Modi .P.N. and Seth .S.M, *"Hydraulics and Fluid Mechanics"*, Standard Book House, 2005.
2.	Rajput .R.K, *"Fluid Mechanics and Hydraulic Machines"*, S.Chand and Company Ltd., 2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Bansal .R.K, *"Fluid Mechanics and Hydraulic Machines"*, Laxmi Publications 2010
4.	M.M.Dandekar and K.N.Sharma, *"Water Power Engineering"*, Vikas ublications 1979

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

ELECTIVE III

CONSTRUCUTION ENGINEERING AND MANAGEMENT

OFFERED IN

IV YEAR, I SEMESTER

ELECTIVE III

15CE430E	ADVANCED CONSTRUCTION TECHNIQUES	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE CONSTRUCTION MANAGEMENT
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To acquire Jknowledge about the various construction techniques carried out and the role of supporting structure

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES			
At the end of the course, student will be able				
1.	To acquire knowledge about the supporting structure in substructure construction	a	e	k	
2.	To know the concept of erection and launching techniques of super structure construction	a	e	k	
3.	To Familiarize with the techniques used in erecting large span structures	a	e	k	
4.	To get an overview about the special structure construction practices	a	e	k	
5.	To understand and learn about various repair and demolition techniques	a	e	k	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: SUB STRUCTURE CONSTRUCTION	**9**			
1.	A frame techniques	1	C,I	1	1,4
2.	Box Jacking ,Pipe jacking	1	C,I	1	1,4,7
3.	Diaphragm walls types and methods	1	C,I	1	1,4,7
4.	Piling techniques- driving well and caisson	2	C,I	1	1,4,7
5.	Sheet piles-construction procedures and applications	1	C,I	1	1,4,7
6.	Cofferdam - methods -cable anchoring	1	C,I	1	1,4
7.	Laying operations for built up offshore system - shoring for deep cutting	1	C,I	1	1
8.	Well points - Trenchless Technology.	1	C,I	1	1
	UNIT II: TALL STRUCTURES CONSTRUCTION	**9**			
9.	Techniques of construction for continuous concreting operation in tall buildings	2	C,I	2	3,7
10.	various shapes and varying sections launching techniques	1	C,I	2	3,7
11.	Slip form techniques - suspended form work	2	C,I	2	3,7
12.	Erection techniques of tall structures, large span structures	1	C,I	2	3,7
13.	Launching techniques for heavy decks	1	C,I	2	3,7
14.	Aerial transporting - handling erecting lightweight components on tall structures	2	C,I	2	3,7
	UNIT III: LARGE SPAN STRUCTURES CONSTRUCTION	**9**			
15.	Types of bridges and loading standards	1	C,I	2,3	3,2
16.	Bow string bridges, cable stayed bridges	2	C,I	2,3	3,2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
17.	Construction aspects and inspection and maintenance of bridges	1	C,I	2,3	3,2
18.	Launching and pushing of box decks	1	C,I	2,3	3,2
19.	Construction sequence and methods in domes and prestressed domes	1	C,I	2,3	3,2
20.	Various construction techniques of domes –methods	2	C,I	2,3	3
21.	Conveyor and machinery in heavy industries	1	C,I	3	3
	UNIT IV: SPECIAL STRUCTURE CONSTRUCTION	**9**			
22.	Erection of lattice towers and rigging of transmission line structures	1	C,I	4	1,3,5,6
23.	Construction procedures of cooling towers, silos, chimney, sky scrapers.	2	C,I	2,3,4	1,3,5,6
24.	Advanced construction techniques in offshore construction practice	1	C,I	4	1,3,5,6
25.	Vacuum dewatering of concrete – white topping – methods and application	2	C,I	4	1,3,5,6
26.	Erection of articulated structures, floating structures-methods	2	C,I	2,3,4	1,3,5,6
27.	Sustainable methods.	1	C,I	4	1,3,5,6
	UNIT V: COMMON STRENGTHENING TECHNIQUES	**9**			
28.	Mud Jacking grout through slab foundation	1	C,I	5	4,8,9,10
29.	Micro piling for strengthening floor and shallow profile pipeline laying	1	C,I	5	3,7
30.	Screw anchors – sub grade water proofing- Under pinning	1	C,I	5	3,7
31.	Crack stabilizing techniques - advanced techniques	1	C,I	5	3,7
32.	Demolition Techniques, Demolition by Machines, Demolition by Explosives- Advanced techniques using Robotic Machines	1	C,I	5	4,9,10
33.	Demolition Sequence, Dismantling Techniques	2	C,I	5	4, 9,10
34.	Safety precaution in Demolition and Dismantling. Explosives and its classification. Sequence in demolition and dismantling.	2	C,I	5	4, 9,10
	Total contact hours			**45**	

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Roy Chudley, Roger Geeno ,"*Advanced Construction Technology*" Latest Edition, 2005.
2.	Ponnuswamy .S,"*Bridge Engineering* "Second Edition, 2008.
3.	Sankar .S.K. And Saraswati .S, Construction Technology, Oxford University Press, New Delhi, 2008.
4.	Gahlot .P.S & Sanjay Sharma ,"*Building repair and maintenance management*" , CBS Publications.2006.
5.	Robertwade Brown, "*Practical Foundation Engineering Hand Book*", Mcgraw Hill Publications, 2005.
	REFERENCE BOOKS/OTHER READING MATERIAL
6.	Patrick Powers .J, "*Construction Dewatering: New Methods And Applications*", John Wiley & Sons, 2002.
7.	Antil J.M., Civil Engineering Construction, McGraw Hill Book Co., 1982.
8.	Peurifoy. R.L., Ledbette. W.B., Construction Planning, Equipment and Methods, McGraw Hill Co., 2000.

| 9. | Ratay. R.T., Hand Book of Temporary Structures in Construction, McGraw Hill, 1984 |
| 10. | Smith. R.C, Andres. C.K., Principles and Practice of Heavy Construction, Prentice Hall, 1986. |

Course nature							Theory	
Assessment Method (Weightage 100%)								
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**	
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**	
					End semester examination Weightage :			**50%**	

15CE431E	CONSTRUCTION RESOURCE PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL ELECTIVE CONSTRUCTION MANAGEMENT				
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	To provide an understanding of resource management concepts, developing the basic knowledge and skills in resource planning and management in the construction industry, assigning resources in construction organization and management, better understanding of conditions, opportunities and ways to put into practice the knowledge gained

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES			
At the end of the course, student will be able					
1.	To study the concepts of construction resource planning, scheduling and to apply appropriate tools and techniques like allocation of resources as per requirement	a	c		
2.	To know the methods of project estimation and obtain the knowledge of planning and preparing budgets for the construction projects.	a	c		
3.	To know the materials and equipments used in construction projects and gain knowledge in proper utilization of procurement.	a	-	e	
4.	To create awareness on resource leveling and resource allocation	-	-	e	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I - RESOURCE PLANNING	**9**			
1.	Introduction to resources	2	C,I	1	1,2
2.	Types of resources	2	C,I	1	1,2
3.	Resource Planning – Material and Money	2	C,I	1	1,2
4.	Resource Planning – Manpower and Equipment	2	C,I	1	1,2
5.	Scheduling Concepts	1	C,I	1	1,2
	UNIT II - COST MANAGEMENT	**9**			
6.	Methods of Estimating project cost (An overview)	2	C,I	1,2	1,2
7.	Classification of Construction cost – Planning resources unit rate, Cost inflation	2	C,I	1,2	1,2
8.	Classification of Construction cost – Escalation and Contingencies	2	C,I	1,2	1,2
9.	Earned value budget	1	C,I	1,2	1,2
10.	Project master budget – Contractors cost control system	2	C,I	1,2	1,2
	UNIT III - MATERIAL MANAGEMENT	**9**			
11.	Time of purchase, Quantity of material, Sources	2	C,I	1,3	1,2,3
12.	Transportation, Delivery and Distribution	2	C,I	1,3	1,2,3
13.	Control methods- Inventory basics	2	C,I	1,3	1,2,3
14.	Inventory Planning – EOQ problems	3	C,I	1,3	1,2,3
	UNIT IV - EQUIPMENT AND LABOUR MANAGEMENT	**9**			
15.	Equipment: Planning and selecting, Extension of Equipment	1	C,I	1,3	1,2
16.	Equipment: Types, Cost control Methods	2	C,I	1,3	1,2
17.	Depreciation and Replacement	2	C,I	1,3	1,2
18.	Labour Administration - Labour, Classes of	2	C,I	1,4	1,2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Labour, Cost of Labour				
19.	Labour schedule, optimum use Labour	2	C,I	1,4	1,2
	UNIT V - RESOURCE SCHEDULING AND ALLOCATION	**9**			
20.	Resource list - Resource Allocation	3	C, I	4	1,2,3
21.	Resource Leveling and Smoothening	2	C, I, O	4	1,2,3
22.	Time-cost trade off	2	C, I	4	1,2,3
23.	Value Management	2	C, I	4	1,2,3
	Total contact hours		**45**		

	LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**	
1.	Chitkara .K.K, "Construction Project Management", McGraw Hill, 2012	
2.	Sharma .S.C, "Construction Engineering and Management", Khanna Publishers, 2008	
	REFERENCE BOOKS/OTHER READING MATERIAL	
3.	Senguptha .B, "Construction Management and Planning", Tata McGraw Hill, 2005.	

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

		L	T	P	C
15CE432E	**ADVANCED CONSTRUCTION PROJECT MANAGEMENT**	**3**	**0**	**0**	**3**

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE CONSTRUCTION MANAGEMENT
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To learn the advanced concepts of construction management in the field of construction engineering and management

INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**			
At the end of the course, student will be able				
1.	To learn and implement of Simulation techniques	a	k	
2.	To know the fundamentals and principles sustainability development	d	e	k
3.	To learn lean construction principles	a	e	k
4.	To learn the various tools of decision making	e	k	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I SIMULATION TECHNIQUES	**9**			
1.	Introduction to Simulation –types of simulation- randomness in simulation	2	C	1	1,2,3
2.	Role of probability and statistics in simulation- characterization of common distribution in simulation	1	C	1	1,2,3
3.	Properties of common distribution- elements of discreet simulation- concepts of events in simulation	1	C, I	1	1,2,3
4.	Common simulation approaches	2	I	1	1,2,3
5.	Event scheduling approach- activity scanning approach	2	C, I	1	1,2,3
6.	Process simulation approach- construction simulation – application of construction simulation	1	C, I	1	1,2
	UNIT II FUNDAMENTALS OF SUSTAINABILITY	**9**			
7.	Fundamentals of Sustainable Construction Engineering	1	C	2	4,5,6
8.	Sustainability and resources, need, present practices	2	C, I	2	4,5,6
9.	Sustainability of construction resources, process modification	2	C, I	2	4,5,6
10.	Product performance evaluation - Sustainability assessment using standard approaches	2	C, I	2	4,5,6
11.	LEED/GRIHA rating evaluation process	2	C, I, O	2	4,5,6
	UNIT III SUSTAINABILITY DEVELOPMENT	**9**			
12.	Tools & Aids available for sustainable construction products	1	C	2	4,5,6
13.	Life Cycle Assessment and Costing	2	C, I	2	4,5,6
14.	Various aspects related to construction cost, present value analysis	2	C, I	2	4,5,6

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
15.	Life cycle stages	2	C, I, O	2	4,5,6
16.	Evaluation criteria, sensitivity analysis, break even analysis	2	C, I, O	2	4,5,6
	UNIT IV LEAN CONSTRUCTION	**9**			
17.	Fundamentals in lean – principles of lean	1	C	3	7,8
18.	Various lean techniques- 5S TECHNIQUE	2	C, I	3	7,8
19.	Last planner technique-increased visualization technique	1	C, I	3	7,8
20.	Daily hurdle meeting-Just In Time	1	C, I	3	7,8
21.	Implementation of lean techniques in construction	1	C, I,	3	7,8
22.	Lean construction and enhanced performance	1	C	3	7,8
23.	Toyato way model- case study	2	C, I,O	3	7,8
24.	**UNIT V DECISION MAKING TOOLS**	**9**			
25.	Virtual reality and BIM concepts	1	C	4	1
26.	Applications of BIM software packages	1	C, I	4	1
27.	Decision making models - Introduction to Artificial Neural Networks				
28.	Concept of Multilayer Feed forward Network (MLFF)- application example- factors affecting MLFF	2	C, I, O	4	1
29.	General Regression Neural Network (GRNN)- application example- factors affecting GRNN	2	C, I, O	4	1
30.	Concept of Probabilistic Neural Network (PNN) – Genetic algorithm – applications.	1	C, I, O	4	1
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	"*Decision making and operations research techniques for construction management*". C.m.tam, thomas k.l.tong h.zhang
2.	Charles J.Kibert, "*Sustainable Construction: Green Buildings Design And Delivery*", John Wiley & Sons, 2005
3.	Lynne elizabeth, cassandra adams, "*alternative construction: contemporary natural building methods*" soft cover, wiley & sons australia limited, john, 2005
4.	Hagger Sustainable Industrial Design and Waste Management, Techniz Book 2010.
	REFERENCE BOOKS/OTHER READING MATERIAL
5.	Helmut Rechberger, Practical handbook of Material Flow Analysis, Taylor & Francis. 2010.
6.	LEED for India: Reference Guide, 2011
7.	"*Lean Construction Management: The Toyota Way*"by Shang Gao, Sui Pheng Low, springer publication.
8.	Lean Construction by luis alarcon , springer publication A A BALKEMAROTTERDAM / BROOKFIELD

In-semester	Assessment tool	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	Total
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**

Course nature — Theory

Assessment Method (Weightage 100%)

End semester examination Weightage : **50%**

ELECTIVE IV

GEOTECHNICAL ENGINEERING AND

STRUCTURAL ENGINEERING

OFFERED IN

IV YEAR, II SEMESTER

ELECTIVE IV
GEOTECHNICAL ENGINEERING

15CE440E	ADVANCED GEOTECHNICAL ENGINEERING	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE308
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE GEOTECHNICAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To assess behavior of various clay minerals, analysis of dewatering in soil, and various aspects of stress analysis, tunneling and coastal structure.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES			
At the end of the course, student will be able to				
1.	Equip themselves familiar with identification of clay minerals and its interaction with water	a	e	
2.	Get familiarized with the design methods for dewatering, flow net analysis for soil	a	e	k
3.	Understand the concept of stress distribution in soil and retaining walls	a	e	k
4.	Improve their ability in analyzing the off shore and special structures	a	e	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: CLAY MINEROLOGY AND STRUCTURE	9			
1.	Introduction – Gravitational and surface forces	1	C	1	1,2,4,5
2.	Electrical charges on clay minerals-bonds	1	C	1	1,2,4,5
3.	Basic structural units of clay - isomorphic substitution	2	C	1	1,2,4,5
4.	Base exchange capacity common clay minerals (Kaolinite, Montmorillionite and illite only)	2	C	1	1,2,4,5
5.	Diffuse double layer	1	C	1	1,2,4,5
6.	Thixotrophy - activity of soils	1	C	1	1,2,4,5
7.	Capillary water – soil suction -capillary potential.	1	C	1	1,2,4,5
	UNIT II: DEWATERING AND FLOW NET	9			
8.	Permeability of soil – aquifers - field methods for permeability - quick sand condition	2	C,D	1	1,2,4,5
9.	Two dimensional flow - Laplace's equation - flow net and it's uses	2	C	2	1,2,4,5
10.	Construction of flow net for sheet pile wall - phreatic lines	2	D,I	2	1,2,4,5
11.	Construction of flow net for earth dams - phreatic lines	1	D,I	2	1,2,4,5
12.	Dewatering – methods - flow to a slot from a single line source and two line source – fully and partially penetrating slot.	2	C,D	2	1,2,4,5
	UNIT III: STRESS DISTRIBUTION	**9**			
13.	Introduction - Newmarks chart – regular and irregular footing	2	C,D	3	1-5
14.	Westergard's stress analysis for various loading conditions	2	C,D	3	1-5
15.	Earth pressure theories - types of retaining walls	2	C	4	1-5
16.	Sheet pile walls – types	1	C	4	1-5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
17.	Pressure distribution diagrams for cantilever sheet pile walls in cohesion less soil.	2	C,D	4	1-5
	UNIT IV: OFFSHORE STRUCTURES	**9**			
18.	Origin, nature and distribution of marine soils – their engineering properties	2	C	4	1-6
19.	sampling and sample disturbance	1	C	4	1-6
20.	Iin-situ testing- Vane shear test, Pressuremeter test, Field permeability test.	2	C	4	1-6
21.	Introduction of fixed and floating platforms	2	C	4	1-6
22.	Steel, concrete and hybrid platforms piling techniques.00	2	C	4	1-6
	UNIT V: SPECIAL STRUCTURES	**9**			
23.	Coffer dams - Caissons and wells– Shafts	2	C	4	1-6
24.	Tunnels classification – methods of tunneling	2	C	4	1-6
25.	construction sequence – stress around tunnels	2	C	4	1-6
26.	Micro tunneling – tunnel lining	1	C	4	1-6
27.	Diaphragm walls – analysis- anchors	2	C	4	1-6
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Shashi K. Gulhati and Manoj Datta., *"Geotechnical Engineering"*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2011.
2.	Joseph .E & Bowles, *"Foundation Analysis & Design"*, McGraw Hill, 1996.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Leonards .G.A, *"Foundation Engineering"*, Tata McGraw-Hill, 1962.
4.	James K. Mitchell, *"Fundamentals of soil behavior"*, John Wiley and Sons, Inc., 1993.
5.	Terzaghi & Peck, *"Soil Mechanics in Engineering Practice"*, Asia Publishing, 1967.
6.	Poulos .H.G, *"Marine Geotechniques"*, Unwin Hyman, London, 1980

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE441E	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE308
Data Book / Codes/Standards	NIL
Course Category	P	PROFESSIONAL ELECTIVE	Geotechnical Engineering
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To develop an understanding of the ground improvement techniques and use of new materials and its behaviour for ground improvement techniques.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES			
At the end of the course, student will be able				
1.	To develop an awareness of problematic soils and selection of ground improvement techniques based on soil conditions	a	e		
2.	To understand drainage, dewatering, grouting technique in ground improvement method.	a	e		
3.	To get the awareness of the ground improvement techniques.	a	e	k	
4.	To study the applications of geosynthetics.	a	e		

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I : PROBLEMATIC SOIL AND GROUND IMPROVEMENT TECHNIQUES	**9**			
1.	Ground improvement - Role of ground improvement in foundation engineering	3	C	1,3	1,3,6
2.	Methods of ground improvement, Geotechnical problems in alluvial, lateritic and black cotton soils.	3	C	1,3	1,3,6
3.	Selection of suitable ground improvement techniques based on soil conditions	3	C	1,3	1,3,4,6
	UNIT II : DEWATEREING	**9**			
4.	Dewatering Techniques - Well points.	3	C	1,2,3	3,6
5.	Vacuum and electro-osmotic methods.	3	C	1,2,3	3,6
6.	Seepage analysis for two dimensional flow - fully and partially penetrated slots in homogeneous deposits (Simple cases only).	3	C	2,3	3,4,6
	UNIT III : GROUND IMPROVEMENT FOR COHESIONLESS AND COHESIVE SOILS	**9**			
7.	In-situ densification of cohesion-less soils and consolidation of cohesive soils:	3	C	1,3	1,2,6
8.	Dynamic compaction Vibroflotation, Sand compaction piles. Consolidation: Preloading with sand drains, and fabric drains.	3	C	13,4	1,3,6
9.	Stone columns	2	C, D	1,3	1,3,4,6
10.	Lime piles-installation techniques only – relative merits and limitations – deep soil mixing.	1	C	1, 3	1, 3 ,4
	UNIT IV : GROUTING TECHNIQUE	**9**			
11.	Grouting - Types of grouts – Suspension grouts - solutions grouts	3	C	2,3	1,2,3,4
12.	Grouting equipment and method - Grouting with soil	3	C	2,3	2,3,4
13.	Bentonite - cement mixes and asphalt - Grout monitoring schemes.	3	C	2,3	1,4
	UNIT V – GEOSYNTHETICS APPLICATIONS	**9**			
14.	Geosynthetics - Types	3	C	2,4	1,2,5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
15.	Functions of Geotextiles – Separation – Filtration – Drainage - reinforcement -	3	C	2,4	1,3,5
16.	Geomembranes - Containments and barriers - Application to Ground Anchors.	3	C	3,4	3,4,5
	Total contact hours				**45**

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Purushothama Raj. P, "*Ground Improvement Techniques*", Laxmi Publications (P) Ltd. New Delhi, 2000.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Koerner. R. M, "*Construction and Geotechnical Methods in Foundation Engineering*", McGraw Hill, new York, 1984.
3.	Moseley. M.P, "*Ground Improvement*", Blockie Academic and Professional, Chapman and Hall, Glassgow, 1998.
4.	Winterkorn .H .F and Fang. H. Y, "*Foundation Engineering Hand Book*", Van Nostrand Reinhold, 1994.
5.	Koerner. R. M, "*Designing with Geosynthetics*" (Fourth Edition), Prentice Hall, New Jersey, 1999.
6.	IS: 13094:1992- "*Selection of ground improvement techniques for foundations in weak soils*", BIS, New Delhi, 1992

Course nature					Theory			
Assessment Method (Weightage 100%)								
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**	
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**	
					End semester examination Weightage :		**50%**	

15CE442E	**STRUCTURES ON EXPANSIVE SOIL**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	15CE308					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE	GEOTECHNICAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To get exposure about various aspects of structures especially constructed on expansive soil.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**				
At the end of the course, student will be able to						
1.	To know the occurrence and distribution of expansive soils	a	e			
2.	To study the properties of expansive soils	a	e			
3.	To understand various methods of prediction of heave	a	e			
4.	To study the design procedure for foundation on expansive soils	a	e	k		
5.	To understand various methods of stabilization used in expansive soils	a	e			

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I : GEOTECHNICAL PROBLEM	**9**			
1.	Occurrence and distribution - Expansive soils of India	3	C	1,2	1,4
2.	Related civil engineering problems - Environmental interaction moisture equilibrium	3	C	1	1,4
3.	Distress symptoms- Factors influencing swelling & shrinkage of soils.	3	C	1	1,4
	UNIT II : EXPANSIVE SOIL PROPERTIES	**9**			
4.	Soil structure and Clay mineralogy	3	C	2	2,3
5.	Field exploration – Identification of expansive soils , free swell, cation exchange capacity	3	C	2	2,3
6.	Expansive index test- classification using engineering index properties.	3	C	2	2,3,4
	UNIT III : HEAVE PREDICTION	**9**			
7.	Methods of prediction of heave - Empirical methods	3	C	,3	1,2,3
8.	Double oedometer tests	3	C	3	1,2,3
9.	Soil moisture- suction - field observations - shrinkage.	3	C	3	1,2,3
	UNIT IV : FOUNDATION DESIGN	**9**			
10.	Recommendations for type of foundation in expansive soils	3	C	4	2,3
11.	Design consideration - Individual and continuous footings	2	C	4	2,3
12.	Stiffened mats - Codal provisions.	2	C	4	2,3
13.	Under reamed piles - codal provisions.	2	C, D	4	2,3
	UNIT V : STABILIZATION	**9**			
14.	Soil stabilization -Method - mechanical stabilization	3	C	5	1,3,4
15.	Cement stabilization – lime stabilization - bituminous stabilization	3	C	,5	1,3,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
16.	Chemical stabilization - Thermal stabilization.	3	C	5	1,3,4
	Total contact hours		45		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	John .D.N & Debora .J.M, "*Expansive Soils Problems And Practice In Foundation & Pavement Engineering*", 1992.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Chenn.F.R, "*Foundation on Expansive Soils*"- Elsevier, 1973.
3.	Parcher.J.V & Means .R.E, "*Soil Mechanics and Foundations*", Columbus, 1968.
4.	Boominathan. S,"*Lecture Notes on Structures on Expansive Soil*", College of Engineering, Guindy, Anna University, Chennai. 1990.

Course nature				Theory		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE443E	INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATION	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE308
Data Book / Codes/Standards	IS5249:1992
Course Category	P PROFESSIONAL ELECTIVE GEOTECHNICAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To assess various design dynamic properties of soil, design of foundation for common machineries and also about the measures to isolate vibration due to the operations of machines.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES			
At the end of the course, student will be able to					
1.	Equip themselves familiar with wave and wave propagation and dynamic properties of soils.	a	e		
2.	Get familiarized with the procedure used for machine foundation design.	a	e	k	
3.	Learn the concept of the vibration isolation and screening techniques.		e	k	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: THEORY OF VIBRATION	9			
1.	Vibration of elementary systems	1	C	1	1,2,4
2.	Vibratory motion-single degree freedom system	2	C	1	1,2,4
3.	Free vibration with and without damping	1	C	1	1,2,4
4.	Forced vibration with and without damping	2	C	1	1,2,4
5.	Principles of vibration measuring instruments.	3	C	1	1,2,4
6.	**UNIT II: WAVES AND WAVE PROPAGATION**	9			
7.	Wave propagation in an elastic homogeneous isotropic medium	3	C	1	1,2,4
8.	Rayleigh, shear and compression waves	3	C	1	1,2,4
9.	Waves in elastic half space (no theoretical treatment or derivation).	3	C	1	1,2,4
10.	**UNIT III: DYNAMIC PROPERTIES OF SOILS**	9			
11.	Elastic properties of soils	2	C	1	1,2,3
12.	Coefficient of elastic uniform and non-uniform compression and shear	2	C	1	1,2,3
13.	Effect of vibration dissipative properties of soils	2	C	1	1,2,3
14.	Determination of dynamic properties of soil - codal provisions – IS:5249- 1992.	3	C	1	1,2,3,5,6
15.	**UNIT IV: DESIGN PROCEDURES FOR SIMPLE MACHINE FOUNDATION**	9			
16.	Design criteria	2	C	2	1-7
17.	Dynamic loads	3	C	2	1-7
18.	simple design procedures for foundations of reciprocating type machines (Treated single degree freedom only)	2	C,D	2	1-7
19.	simple design procedures for foundations of impact type machines (Treated single degree freedom only)	2	C,D	2	1-7
20.	**UNIT V: VIBRATION ISOLATION AND SCREENING**	9			
21.	Vibration isolation technique	3	C	3	1-7
22.	Foundation isolation- isolation by location	3	C,D	3	1-7
23.	Isolation by barriers active and passive isolation	3	C,D	3	1-7

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	methods				
	Total contact hours			**45**	

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Swamisaran, "*Soil Dynamics and Machine Foundations*", Galgotia Publications Pvt. Ltd. 2010.
2.	Prakash.S, and Puri,V.K., *"Foundation for Machines"*, McGraw Hill Publishing Company, Newyork, 1988.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Kameswara Rao, "*Dynamics Soil Tests and Applications*", Wheeler Publishing, New Delhi, 2003.
4.	Kamaswara Rao, "*Vibration Analysis and Foundation Dynamics*", Wheeler Publishing, New Delhi, 1998.
5.	IS 2974 Code (Part I to IV) of Practice for "*Design and Construction of Machine Foundations*", Bureau of Indian Standards, New Delhi.
6.	IS 5249 Code of Practice for "*Method of test for determination of dynamic properties of soil*" Bureau of Indian Standards, New Delhi.
7.	Moore.P.J, "*Analysis and Design of Foundation for Vibration*", Oxford and IBH, 2005.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

	15CE444E	**ENVIRONMENTAL GEOTECHNOLOGY**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Co-requisite:	NIL
Prerequisite:	15CE309
Data Book / Codes/Standards	NIL
Course Category	P	PROFESSIONAL ELECTIVE	GEOTECHNICAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To develop an understanding of the geotechnical aspects in the disposal of waste materials and the remediation of environmentally contaminated sites.

INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**			
At the end of the course, student will be able to				
1.	Learn the concept of interaction between waste and soil and pollutant movement in the ground.	a	e	k	
2.	Get familiarized with the role of geotechnical engineering in waste management.		e	k	
3.	Improve their ability in waste disposal and management system and ground remediation technologies.			k	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: INTRODUCTION	9			
1.	Introduction to environmental geotechnology	1	C	1	1,2,3
2.	Environmental cycles & interaction	2	C	1	1,2,3
3.	Soil water environment interaction	3	C	1	1,2,3
4.	Causes of soil pollution	2	C	1	1,2,3
5.	Factors governing soil pollutant interaction	1	C	1	1,2,3
	UNIT II: SOURCES OF WASTES AND CONTAMINANT TRANSPORT	9			
6.	Waste characteristics - Sources and types of wastes	2	C	1	1,2,3
7.	Contaminant transport in sub surface : advection, diffusion, dispersion	2	C	1	1,2,3
8.	Contaminant transformation : sorption, biodegradation, ion exchange, precipitation	2	C	1	1,2,3
9.	Ground water pollution : pollution of aquifers by mixing of liquid waste – protecting aquifers.	3	C	1	1,2,3
	UNIT III: WASTE DISPOSAL METHODS	**9**			
10.	Objectives of waste disposal facilities – site selection criteria for waste disposal	3	C	2,3	1,2,3
11.	Methods of disposal: surface impoundment systems	3	C	2,3	1,2,3
12.	Sub-surface disposal, passive containment systems	2	C	2,3	1,2,3
13.	landfills	1	C	2,3	1,2,3
	UNIT IV: LANDFILLS	**9**			
14.	Landfill – types, requirements, components - Site selection	2	C	3	1,2,3
15.	Leachate and gas generation – primary and secondary leachate	1	C,D	3	1,2,3
16.	Leachate collection and removal system– gas collection and removal system	2	C,D	3	
17.	Landfill liners – compacted clay liners, geosynthetic clay liners, geomembrane liners.	2	C,D	3	1,2,3
18.	Landfill cover system – end uses of closed landfills.	2		3	
	UNIT V:GROUND REMEDIATIONTECHNOLOGIES	**9**			
19.	Soil remediation technologies: soil washing	2	C	3	1,2,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
20.	Electrokinetic remediation	1	C	3	1,2,3
21.	Soil vapour extraction, bioremediation, stabilization and solidification.	2	C	3	1,2,3
22.	Ground water remediation technologies	1	C	3	1,2,3
23.	Pump and treat, insitu flushing,	1	C	3	1,2,3
24.	bioremediation, air sparging, reactive well.	2	C	3	1,2,3
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Hsai- Yang Fang, "*Introduction to Environmental Geotechnology,- CRC Press*", New York, 2009.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	David. E. Daniel, "*Geotechnical practice for waste disposal*"– Chapman and Hall – London, 1993.
3.	Wentz .C.A, Hazardous, "*Waste Management*", McGraw Hill Publishing Company, Singapore, 1989.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE450E	**COMPUTER ANALYSIS OF STRUCTURES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Co-requisite:	NIL
Prerequisite:	15CE301
Data Book / Codes/Standards	NIL
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To introduce matrix force and displacement methods and apply to two and three dimensional structures with programming aspects.

INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course, student will be able	
1.	To introduce fundamentals of matrix analysis – Principle of superposition and to formulate flexibility and stiffness matrices of spring systems and elements.	a
2.	To apply energy concepts to develop nodal load vectors.	b
3.	To analyze a structure by stiffness and flexibility methods	c
4.	To analyze and design a structure using computer software packages.	d
5.	To introduce Finite Element method.	e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: INTRODUCTION	**9**			
1.	Introduction to syllabus - Force and Displacement	1	C	1	2,4,5,6,10,11
2.	Generalized or independent measurements	1	C	1	2,4,5,6,10,11
3.	Constrained or dependent measurements	1	C	1	2,4,5,6,10,11
4.	N dimensional space – principle of superposition	1	C	1	2,4,5,6,10,11
5.	Methods of structural analysis structure with single and two coordinates	1	C	1	2,4,5,6,10,11
6.	Flexibility and stiffness matrices in coordinates - examples	1	I	1	2,4,5,6,10,11
7.	Symmetric nature – constrained measurements	1	C	1	2,4,5,6,10,11
8.	Stiffness and flexibility matrices of the element as well as the system	1	C	1	2,4,5,6,10,11
9.	Computing the influence coefficient	1	C	1	2,4,5,6,10,11
	UNIT II: ENERGY CONCEPTS	**5**			
10.	Strain energy in terms of stiffness and flexibility matrices	3	C	2	2,3
11.	Interpretation of coefficient- Betti's law	1	C	2	2,3
12.	Other energy theorems using matrix notation	1	C	2	2,3
	UNIT III: FLEXIBITY AND STIFFNESS METHODS (ELEMENT APPROACH)	**15**			
13.	Choice of redundant – ill and well condition equation -transformation matrices	1	C	3	4,5,10,11
14.	Transformation of one set redundant to other set – thermal expansion – lack of fit	1	C	3	4.5,10,11
15.	Application of pin jointed plane truss – continuous beams , frames and grids	4	I	3	4,5,10,11
16.	Development of stiffness method- analogy between flexibility and stiffness – analysis due to thermal	2	C,I	3	4,5,10,11

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	expansion				
17.	Lack of fit - Stiffness matrix with rigid body motion	1	C	3	4,5,10,11
18.	Application to pin jointed plane and space trusses – continuous beams- frames and grids	4	I	3	4,5,10,11
19.	Problem solving by computer – choice of the method	2	I	3	4,5,10,11
	UNIT IV: COMPUTER APPLICATIONS	**10**			
20.	Analysis and design of pin jointed and rigid jointed frame structures using STADD Pro (2D &3D)	6	I,D	4	1,9
21.	Introduction to SAP, ETABS,ABACUS	4	I	4	1,9
22.	**UNIT V: INTRODUCTION TO FINITE ELEMENT METHOD**	**6**			
23.	Basic concepts – Raleigh Ritz method	1	C	5	7,8
24.	Finite difference method - variational principles1	1	C	5	7,8
25.	MWR(theory only) – steps in finite element method – axial element force formulation by displacement method	2	C	5	7,8
26.	Theory of stress model – Hybrid model- Displacement model	2	I	5	7,8
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Krishnamoorthy .C.S, Rajeev .S, "*Computer Aided Design*", Narosa Publishing House, New Delhi 1991.
2.	Rajasekaran .S, Sankarrasubramanian .G, "*Computational Structural Mechanics*", prentice-Hall of India Pvt, 2006.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Chandramouli.P.N " *Structural Analysis*",Yesdee publications,2015
4.	Beaufait .F.W "*Computer Methods of Structural Analysis*", Prentice Hall, 1970.
5.	Meek .J.L, "*Matrix Structural Analysis*", McGraw Hill Kogakusha Ltd.,1971.
6.	Harrision.H.B., "*Structural Analysis and Design*" Vol. II, Pergamon Press, 1991 & I.
7.	Hinton .E, Owen.D.R.J, "*Finite Element Programming*", Academic press, 1977
8.	K.J.Bathe., "*Finite Element Procedures*", February 15, 2007
9.	Billy E.Gillet, "*Introduction to Operations Research*", A Computer Oriented Algorithmic approach, Tata McGraw Hill Co., 1982.
10.	Mcquire and Gallagher, R.H., "*Matrix Structural Analysis*", John Wiley, 1979
11.	.Rubinstein .M.F, "*Matrix Computer Analysis of Structures*", Prentice Hall, 1966

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

	15CE451E	COMPUTER AIDED DESIGN OF STRUCTURES	L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	15CE302					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting, 2016					

PURPOSE	To familiarize with hardware, software aspects of computer graphics including application of FEM and optimization technique.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES			
At the end of the course, student will be able to				
1.	Know about graphic primitives.	a	c	e	k
2.	Acquire knowledge about optimization and design principles.	a	c	e	k
3.	Get exposure on finite element method and to apply for simple problems.	a	c	e	k
4.	Gain knowledge on the use of standard software packages for analysis.	a	c	e	k
5.	Gain knowledge on the use of standard software packages for design	a	c	e	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: UNIT I –INTRODUCTION & COMPUTER GRAPHICS	**9**			
1.	Fundamentals of CAD	1	C	1	4,7
2.	Hardware and Software requirements	1	I	1	4,7
3.	Design process	1	C,D	1	4,7
4.	Application and benefits	1	C,D	1	4,7
5.	Graphic primitives	1	C	1	4,7
6.	Wire frame modeling	1	I	1	4,7
7.	Solid modeling	1	I	1	4,7
8.	Drafting packages	1	C	1	4,7
9.	Applications to layout of buildings and structures using AUTOCAD	1	I	1	4,7
	UNIT II: DESIGN & OPTIMIZATION	**9**			
10.	Principles of design of steel and RC structures	1	C	2	6
11.	Applications of optimization techniques to simple design problems	2	D, I		6
12.	User interactive format, input, output techniques	1	I		6
13.	Display techniques	1	I	2	6
14.	Server control techniques and feedback systems	1	I	2	6
15.	Introduction to MS PROJECT	1	C	2	6
16.	Introduction to PRIMAVERA	2	C	2	6
	UNIT III: INTRODUCTION TO FINITE ELEMENT ANALYSIS	**12**			
17.	Fundamentals of Finite Element Analysis	1	C	3	1,2,3,8
18.	Steps involved in finite element formulation	1	I	3	1,2,3,8
19.	Formulation of Boundary value problems	1	I	3	1,2,3,8
20.	Galerkin's approach to finite element formulation	1	C	3	1,2,3,8
21.	Variational principles to finite element formulation	1	C	3	1,2,3,8
22.	Isoparametic finite element formulations and field application of isoparametric formulations	1	I	3	1,2,3,8
23.	Finite Element Divisions and convergence	1	I	3	1,2,3,8
24.	Generation of Element stiffness matrix and assembling	1	I	3	1,2,3,8

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	global structure stiffness matrix				
25.	Matrix and solution for deflection and derivation of stresses and strains from deflection	2	I	3	1,2,3,8
26.	Simple problem using triangular elements	2	I	3	1,2,3,8
	UNIT IV: ANALYSIS OF STRUCTURES BY FINITE ELEMENT METHOD	**9**			
27.	Input for analysis of plane and space trusses using SAP, STAAD.Pro and ETABS – for gravity loads	2	I	4	9,10,11
28.	Understanding and interpretation of output	1	I	4	9,10,11
29.	Input for analysis of plane and space frames using SAP, STAAD.Pro and ETABS for gravity loads	2	I	4	9,10,11
30.	Understanding and interpretation of output in SAP, STAAD.Pro and ETABS	**2**	I	4	9,10,11
31.	Generation and application of wind loads on structures in SAP, STAAD.Pro and ETABS	1	I	4	9,10,11
32.	Generation and application of seismic loads on structures using response spectrum method in SAP, STAAD.Pro and ETABS	1	I	4	9,10,11
33.	**UNIT V: DESIGN OF STRUCTURES BY FINITE ELEMENT METHOD**	**6**			
34.	Input for design of plane and space trusses using SAP, STAAD.Pro and ETABS – for gravity loads	1	I	5	9,10,11
35.	Understanding and interpretation of output	1	I	5	9,10,11
36.	Input for design of plane and space frames using SAP, STAAD.Pro and ETABS for gravity loads	2	I	5	9,10,11
37.	Understanding and interpretation of design output in SAP, STAAD.Pro and ETABS for space and plane frames	1	I	5	9,10,11
38.	Input for design of structures for wind and seismic loads in SAP, STAAD.Pro and ETABS and load combinations	1	I	5	9,10,11
39.	Modeling and analysis of suspension cable bridges, arches and water tanks using SAP, STAAD.Pro and ETABS	1	I	5	9,10,11
	Total contact hours	**45**			

Sl.No.	
LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Krishnamoorthy .C.S. and Rajeev .S, "*Computer Aided Design*", - Narosa Publishing House, New Delhi 1991.
2.	Rajasekaran .S, "*Finite Element Analysis*", - A.H. Wheelers Publishing Co. Ltd., 1993.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Rao .S.S, "*The Finite Element Method in Engineering*", Fourth Edition, Elsevier,2006.
4.	Grover .M.P and Zimmers E.W.Jr. CAD/CAM, "*Computer Aided Design and Manufacturing*", - Prentice Hall of India Ltd., 1996..
5.	Harrison .H.B, "*Structural Analysis and Design*", Parts I and II - Pergamon Press, Oxford, 1970.
6.	Rao.S.S "*Optimization Theory and Applications*" - Wiley Eastern Ltd. New Delhi 1977.
7.	AUTOCAD Manual, 2000.
8.	REDDY, '*Finite Element Methods*", II Edn. - McGraw Hill Co., 1993.
9.	*https://www.bentley.com/en/products/brands/staad*
10.	*https://www.csiamerica.com/products/etabs*
11.	*https://www.csiamerica.com/products/sap2000*

Course nature		Theory				
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**
End semester examination Weightage : 50%						

15CE452E		TALL BUILDINGS		L	T	P	C
				3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	IS: 875 Part 2, 3, IS: 1893 Part 1
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To impart the overall knowledge about the elements and systems with planning, analysis and design involved in Tall Buildings.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES		
At the end of the course, student will be able				
1.	To get an introduction to various aspects of planning of Tall Buildings	a	e	k
2.	To know about different types of loads	a	e	k
3.	To get an introduction to various structural systems for medium rise buildings with their behaviour and analysis	a	e	k
4.	To get an introduction to various structural systems for high rise buildings with their behaviour and analysis	a	e	k
5.	To acquire knowledge about stability analysis of various systems and to know about advanced topics	a	e	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I – INTRODUCTION	**9**	C	1	1-3
1.	Design Philosophy-History-Advantages and disadvantages	2	C	1	1-3
2.	Vertical city concepts - Essential amenities	1	C	1	1-3
3.	Fire safety -Water supply - Drainage and garbage disposal	1	C	1	1-3
4.	Service systems	1	C	1	1-3
5.	Structural and Foundation systems	2	C	1	1-3
6.	Factors affecting height, growth and Structural form	1	C	1	1-3
7.	Human comfort criteria.	1	C	1	1-3
	UNIT II – LOADS	**10**			
8.	Gravity Loading - Dead and Live Load as per IS 875: Part 1 and 2	1	C, D	2	8
9.	Reduction of Live Load – Problem solving as per IS 875: Part 2	1	C, D	2	8
10.	Impact and Construction Loads	1	C	2	1,2
11.	Wind loading as per IS 875: Part 3 – k_1, k_2, k_3 factors, quasi static method of load computation on RCC framed structures	3	C, D	2	8
12.	Earthquake loading – introduction to IS: 1893 Part 1-Definitions, Concept of response spectrum	1	C, D	2	9
13.	Base shear computation as per IS:1893 Part 1, Seismic Coefficient Method	2	C, D	2	9
14.	Combination of loading	1	C	2	10
	UNIT III – MEDIUM RISE BUILDINGS-BEHAVIOUR AND ANALYSIS	**9**			
15.	Medium rise structures- Vertical and Horizontal load resistant systems – Behaviour of RCC Rigid frames with and without infills	3	C, I	3	1-2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
16.	RCC Rigid frames without infills –problem solving using portal method	3	C, I	3	1-2
17.	RCC Rigid frames without infills –problem solving using cantilever method	2	C, I	3	1-2
18.	Infill frames – equivalent diagonal strut	1	C, I	3	1-2
	UNIT IV– HIGH RISE BUILDINGS-BEHAVIOUR AND ANALYSIS	**8**			
19.	Behaviour of High rise structures -Vertical and Horizontal load transfer systems	**1**	C	4	1-2
20.	Braced frames – Behaviour Problem solving to find approximate drift	**2**	C, I	4	1-2
21.	Shear walls- Behaviour	1	C	4	1-2
22.	Wall frames - Behaviour	1	C	4	1-2
23.	Tubular systems – Behviour of Framed Tubular system	1	C	4	1-2
24.	Tubular systems – Behviour of Bundled Tubular system	1	C	4	1-2
25.	Outrigger-braced systems – behavior	1	C	4	1-2
	UNIT V– ADVANCED TOPICS	**9**			
26.	Stability Analysis (Qualitative Treatment only) - Overall buckling analysis of frames	2	C, I		1,2, 3,4,5,6,7
27.	Stability Analysis (Qualitative Treatment only) - Overall buckling analysis of Wall Frames	2			1,2, 3,4,5,6,7
28.	P-Δ effects and various methods of analysis	1	C, I		1,2, 3,4,5,6,7
29.	Influence of foundation instability	1	C		1,2, 3,4,5,6,7
30.	Elastic Deformations. Analysis for various secondary effects	1	C		1,2, 3,4,5,6,7
31.	Effect of Creep on tall buildings	1	C		1,2, 3,4,5,6,7
32.	Effect of Shrinkage and Temperature on tall buildings	1	C		1,2, 3,4,5,6,7
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Smith.B.S and Coull.A, "*Tall Building structures- Analysis and Design*" John Wiley & Sons, 1991.
2.	Taranath.B.S, "*Structural Analysis and Design of Tall Buildings*", Mc Graw Hill co., 1988.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Schuller .W.G, "*High Rise Building Structures*", John Wiley & Sons, 1977.
4.	Lynn.S.Beedle, "*Advances in Tall Buildings*", CBS Publishers and Distributers, New Delhi,1986.
5.	Lin .T.Y and Stotes Burry.D, "*Structural Concepts and Systems for Architects and Engineers*", John Wiley & Sons, 1988.
6.	Dr.Gupta.Y.P, mEditor, "*Proceedings of National Seminar on High Rise Structures- Design and construction Practices for Middle Level Cities*", Nov.14-16, 1955, New Age International Pub. Ltd., Chennai.
7.	Lecture Notes on, "*Tall Buildings*" - Short term Course Organised by Civil Engineering Dept., SRM Engineering College, Kattankulathur. June 2002.
8.	IS: 875(Parts 1,2,3): "*Code of Practice for Design Loads on Buildings and Structures*", BIS, New Delhi, 1987 (Reaffirmed 2003)
9.	IS : 1893 (Part1): , "*Criteria For Earthquake Resistant Design Of Structures*", BIS, New Delhi, 2002

10.	IS: 456:, "*Plain And Reinforced Concrete - Code Of Practice*", BIS, New Delhi, 2000 (Reaffirmed 2005)

Course nature		Theory				
Assessment Method						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**
End semester examination Weightage : 50%						

15CE453E	STORAGE AND INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE204
Data Book / Codes/Standards	IS : 8640-1977, IS : 3483-1965, IS : 1644-1988
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting, 2016

PURPOSE	To get exposed to the design of industrial structures and their functional requirements.			
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able to				
1.	Understand the functional planning of industrial structures including lighting and ventilation	a	c	e
2.	Design of steel gable frame with knee joint, beam column, base plate and anchor bolt are dealt with here	a	c	e
3.	Design RC silos, bunkers	a	c	e
4.	Design RC Chimney and cooling tower	a	c	e
5.	Understand general principles of prefabrication and functional requirements of precast concrete units and composite sections	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: INTRODUCTION AND FUNCTIONAL REQUIREMENTS	**7**			
1.	Classification of Industries and Industrial structures	1	C	1	1,4,5,6
2.	General requirements for industries like cement, chemical and steel plants like site layout, Lighting and Ventilation.	3	C,D	1	1,4,5,6
3.	General requirements for industries like cement, chemical and steel plants like Fire safety electrical installations and Guidelines from factories etc	3	C,D,I	1	1,4,5,6
	UNIT II: DESIGN OF STEEL GABLE FRAME AND BEAM COLUMNS	**9**			
4.	Design of steel gable frame with knee joint	2	C,D	2	1,4,5,6
5.	Design of steel gable frame with beam column	2	C,D,I	2	1,4,5,6
6.	Design of steel gable frame with base plate and anchor bolt.	5	C,D,I	2	1,4,5,6
	UNIT III: DESIGN OF RC SILOS AND BUNKERS	**11**			
7.	Design of RC silos.	6	C,D,I	3	2,3
8.	Design of RC bunkers.	5	C,D,I	3	2,3
	UNIT IV: DESIGN OF RC CHIMNEYS AND COOLING TOWER	**11**			
9.	Design of RC chimneys	6	C,D,I	4	2,3
10.	Design of RC cooling tower	5	C,D,I	4	2,3
	UNIT V: PREFABRICATION	**7**			
11.	Principles of Prefabrication, modular coordination, advantages and limitations	2	C	5	7,8
12.	Functional requirements of precast concrete units, beams and columns	2	C	5	7,8
13.	Functional requirements of walls, roof trusses and footings	2	C	5	7,8
14.	Joints in prefab elements and erection of precast elements.	1	C	5	7,8

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Subramanian.N, "*Design of Steel Structures*", Oxford University Press, New Delhi, 2008.
2.	Krishna Raju.N, "*Advanced Concrete Structures*", McGraw Hill, New Delhi, 2000.
3.	Varghese.P.C., "*Advanced Reinforced Cement Concrete*", Pretince-Hall India, Second edition, 2006 .
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Ramchandra .S., Virendra Ghelot, "*Design of Steel of Structures*", Volume 1, Scientific Publishers, 2009, New Delhi.
5.	Duggal.S.K. "*Limit State Design of Steel Structures*", Tata McGraw Hill Publishing Company, New Delhi, 1st Edn., 2010.
6.	Edwin H. Gaylord, Charles N. Gaylord, Japes R. Stallmeyer, "*Steel Structures*", McGraw Hill, NewDelhi, 1995.
7.	CBRI, Building materials and components, India, 1990.
8.	Laszlo Mokk, *"Prefabricated Concrete for Industrial and Public Structures"*, Akademiai Kiado, Budapest, 2007.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE454E	ADVANCED PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	IS: 1343-2012 and IS: 456-2000				
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING		
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	To provide an exposure to the design of Prestressed Concrete Structures and StructuralElements

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES		
At the end of the course, student will be able to				
1.	Learn the prestressing concepts, principles and methods	a	c	e
2.	Determine losses in prestress & anchorage zone stresses	a	c	e
3.	Compute shear strength and ultimate shear resistance capacity as per IS code	a	c	e
4.	Design of prestressed concrete beams, stresses at transfer, service load, limit state of collapse in flexure and shear	a	c	e
5.	Design prestressed concrete slabs	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I-INTRODUCTION AND ANALYSIS FOR STRESSES	**9**			
1.	Basic concepts - terminology	1	C	1-5	1-5
2.	System of prestressing - pretensioning – posttensioning	1	C,D	1	1-5
3.	Principle of prestressing - types of prestressing. Assumptions	1	C,D	1	1-5
4.	Analysis of prestress- concentric & eccentric tendon	1	C,D	1	1-5
5.	Resultant stresses	1	C,D	1	1-5
6.	Rectangle - I-section (symmetrical only)	1	C,D	1	1-5
7.	Concepts of prestressing	1	C	1	1-5
8.	Stress concept, strength concept	1	C	1	1-5
9.	Load balancing concept	1	C	1	1-5
	UNIT II-LOSS OF PRESTRESS AND ANCHORAGE ZONE STRESSES	**9**			
10.	Losses of prestress - types	1	C	2	1-3
11.	Losses due to elastic deformation of concrete	2	C,D	2	1-3
12.	Shrinkage of concrete - creep of concrete	2	C,D	2	1-3
13.	Friction - anchorage slip.	1	C,D	2	1-3
14.	Anchorage zone stresses -stress distribution in end block	2	C,D	2	1-3
15.	Investigations on anchorage zone - Indian code provision only stresses	1	C.D.I	2	1-3
	UNIT III-SHEAR STRENGTH	**7**			
16.	Behavior of prestressed concrete members under shear	2	C,D	3	1-3
17.	Shear strength - principal stresses	2	C,D	3	1-3
18.	Ultimate shear resistance - Indian Standard code provision	3	C,D,I	3	1-3
	UNIT IV-DESIGN OF PRESTRESSED CONCRETE BEAM	**11**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
19.	Design of sections for flexure	3	C,D	4	1-3, 6,7
20.	Stress condition - minimum section modulus	2	C,D,I	4	1-3, 6,7
21.	Stresses at transfer - service loads - prestressing force - eccentricity	2	C,D,I	4	1-3, 6,7
22. .	Check for stresses - initial and final conditions	2	C,D,I	4	1-3, 6,7
23.	Limit state of collapse in flexure - shear. (Rectangular Section only)	2	C,D,I	4	1-3, 6,7
	UNIT V- DESIGN OF PRESTRESSED CONCRETE SLAB	**9**			
24.	Types of prestressed concrete slab	1	C,D	5	1-3, 6,7
25.	Design of one-way slab	2	C,D	5	1-3, 6,7
26.	Design of two-way slab	3	C,D,I	5	1-3, 6,7
27.	Design of simple flat slab	3	C,D,I	5	1-3, 6,7
Total contact hours		**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Krishnaraju .R, "*Prestressed Concrete*", Tata McGraw-Hill Education, NewDelhi, 2006
2.	Pandit .G.S, Gupta .S.P, "P*restressed Concrete*", CBS Publishers & Distributors, 2008
3.	Rajagopalan .N, "*Prestressed Concrete*", Alpha Science International,Limited, 2005.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Lin T.Y, Design of, "*Prestressed Concrete Structures*", Asia Publishing House, Bombay 1995.
5.	Guyon .V, "*Limit State Design of Prestressed Concrete*", Vol.I & II Applied Science Publishers, London, 1992.
6.	*IS: 1343- 2012 "IS Code Of Practice For Prestressed Concrete",* BIS, New Delhi, 2012.
7.	*IS: 456- 2000 "Plain and Reinforced Concrete – Code of Practice",* BIS, New Delhi, 2000

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15CE455E	ADVANCED STRUCTURAL DESIGN	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE204
Data Book / Codes/Standards	IS:456- 2000, IS: 1893-2002 (Part 1), IS : 875-1987 (Part 3) , IRC: 112-2011, IRC : 22-2010, SP(16)
Course Category	P | PROFESSIONAL ELECTIVE | STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting, 2016

PURPOSE	To bring about a thorough understanding of limit state design of continuous beams, design of grid floors and design of space frames, analysis of frames, design of bridges, shells and folded plates.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES		
At the end of the course, student will be able to			
1. Study the limit state design methodology as applicable to continuous beams.	a	c	e
2. Understand the behaviour of grid floors, to carry out their design and to study principles of steel space frames.	a	c	e
3. Study approximate analysis methods of medium rise framed building.	a	c	e
4. Get exposed to the design of small span bridges and design principles of steel bridges.	a	c	e
5. Study the analysis and design of folded plates and shells.	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I : LIMIT ANALYSIS OF CONTINUOUS / FIXED BEAMS	**9**			
1.	Behaviour of reinforced concrete members in bending and shear	1	C	1	2,4
2.	Plastic hinge, rotation capacity and factors affecting rotation capacity of a section	2	C	1	2,4
3.	Plastic moment and moment curvature relationship	1	C	1	2,4
4.	Analysis, redistribution of moments and limit state design of continuous beams(Two Span only)	3	C, D	1	2,4
5.	Analysis, redistribution of moments and limit state design of fixed beams	2	C, D	1	2,4
	UNIT II: DESIGN OF GRID FLOORS AND SPACE FRAMES	**9**			
6.	Behaviour of, and analysis theories	**2**	C	2	1,2
7.	Design of waffle slab and grid system as per IS456-2000	3	C, D	2	1,2
8.	Steel Space frames-types	1	C	2	8,9
9.	Steel Space analysis and design principles	3	C, D	2	8,9
	UNIT III: DESIGN OF MEDIUM RISE FRAMED BUILDINGS	**9**			
10.	Planning of structural layout of slabs, beams , columns	1	C, I	3	1,2,4,10-12
11.	Computation of design moments and shears using substitute frame method of IS 456 and explanatory handbooks	2	C, D	3	1,2,4,10-12
12.	Estimation of wind loads as per IS: 875	1	C, I	3	1,2,4,10-12
13.	Estimation of seismic forces as per IS: 1893	1	C, I	3	1,2,4,10-12
14.	Analysis by portal and cantilever methods	2	C, I	3	1,2,4,10-12
15.	Combination of internal forces due to live, dead and	1	C, I	3	1,2,4,10-12

CE-Engg&Tech-SRM-2015

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	lateral loads				
16.	Design of key members using design aids (SP16).	1	C, D	3	1,2,4,10-12
	UNIT IV:DESIGN OF BRIDGES	**9**			
17.	IRC Specifications for Road Bridges	1	C	4	6,7,14,15
18.	Standard Live loads, other forces on Bridges	1	C	4	6,7,14,15
19.	General Design Considerations and codal provisions	1	C, D	4	6,7,14,15
20.	Design of Slab Culverts for Class AA, 70R and Class A loading	2	D	4	6,7,14,15
21.	Lay out of Tee beam Bridges and computation of effective loads on girders using Courbon's theory	2	C, I	4	6,7,14,15
22.	Construction of Influence line diagrams and computation of maximum moments and shears on simple spans for Class AA, 70R and Class A loading	2	C, I	4	6,7,14,15
	UNIT V: SHELLS AND FOLDED PLATES	**9**			
23.	Concept of shells and classification of shells as per IS codes	2	C, I	5	3,5, 13
24.	Membrane theory of shells	1	C	5	3,5, 13
25.	Design of circular cylindrical shells using beam method.	3	C, D	5	3,5, 13
26.	Design of prismatic folded plates	3	C, D	5	3,5, 13
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Krishna Raju," *Advanced Concrete Structures"*, McGraw Hill, New Delhi, 2000.
2.	Varghese.P.C, "*Advanced Reinforced Cement Concrete"*, Pretince-Hall India, Second edition, 2006
3.	Varghese.P.C, "*Design Of Concrete Shells And Folded Plates"*, PHI learning Pvt. Ltd., 2010.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Unnikrishna Pillai.S and Deavadas Menon, "*Reinforced Concrete Design"*, Tata MacGraw Hill Publishing Company Limited, Second Edition, New Delhi, 2003.
5.	Ramaswamy.G.S, "*Design, Construction of Concrete Shell Roofs'*, CBS Publishers & Distributors, 2005.
6.	Krishna Raju.N, "*Design of Bridges"*, Oxford & IBH Publishing Company Pvt. Ltd.,Fourth edition, 2010.
7.	Johnson Victor.D, "*Essentials Of Bridge Engineering"*, 6/E, Oxford & IBH Publishing Company Pvt. Ltd.,Fourth edition, 2007.
8.	Eekhout. M, Suresh .G.R, "*Analysis, Design, and Construction of Steel Space Frames"*, Thomas Telford, 2002.
9.	Subramanian .N, "*Space Structures: Principles and Practice, Volume 1"*, Multi-Science Pub., 2006.
10.	Krishnaraju .R, Pranesh .R.N, "*Design of Reinforced concrete" IS : 456-2000*, New age International Publication (P) Ltd., New Delhi
11.	*"Design Aids for Reinforced Concrete"* to IS 456, Special Publication (SP16), BIS New Delhi, 1980.
12.	IS456:2000, *"Code of Practice for Plain and Reinforced Concrete"*, BIS, New Delhi
13.	IS:2210:1988, *"Criteria For Design Of Reinforced Concrete Shell Structures And Folded Plates", BIS, New Delhi, 1988*

14.	IRC:112-2011, *"Code of Practice for Concrete Road Bridges"* Indian Road Congress, New Delhi, 2011
15.	IRC:22-2010, *"Standard Specifications and Code of Practice for Road Bridges"*, Indian Road Congress, New Delhi, 2011

Course nature				Theory		
Assessment Method						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**
End semester examination Weightage : 50%						

15CE456E	ANALYSIS AND DESIGN OF STRUCTURAL SANDWICH PANELS	L	T	P	C
		3	0	0	3
Co-requisite:	NIL				
Prerequisite:	15CE202				
Data Book / Codes/Standards	NIL				
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING		
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	To introduce the basic principles related to the structural sandwich panels
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**

	At the end of the course, student will be able			
1.	To learn about various standards for testing and procedures.	b		
2.	To learn about methods of analysis of sandwich panels.	a	e	k
3.	To know about design methodologies of sandwich panels.	a	e	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: MATERIALS AND TESTING OF SANDWICH PANELS	**9**			
1.	Functions and Classification of Core materials	2	C	1	1
2.	Functions and Classification of Skin Materials	2	C	1	1
3.	Typical values for Properties of materials	2	C	1	1
4.	Methods of Testing of materials used in sandwich constructions.	3	C	1	1
	UNIT II: ANALYSIS OF SANDWICH FLEXURAL ELEMENTS	**10**			
5.	Introduction to Sandwich beams behaviour	2	C	2	1
6.	Analysis of Antiplane core and thin faces of equal thickness	1	C	2	1
7.	Analysis of Antiplane core and thin faces of unequal thickness	2	C	2	1
8.	Cases of core with considerable value of modulus of elasticity	2	C	2	1
9.	Deflection of Sandwich beams due to symmetrical load	1	C	2	1
10.	Deflection of Sandwich beams due to unsymmetrical load including point load and udl	2	C	2	1
	UNIT III: BUCKLING OF SANDWICH STRUTS	**8**			
11.	Phenomenon of Buckling of Sandwich struts	2	C	2	1
12.	Analysis of sandwich beam by strain energy method	2	C	2	1
13.	Analysis of sandwich strut by strain energy method	1	C	2	1
14.	Analysis of Isotropic sandwich struts by Ritz's method	2	C	2	1
15.	Analysis of Orthotropic sandwich struts by Ritz's method	1	C	2	1
	UNIT IV: SANDWICH PANELS UNDER BENDING AND BUCKLING	**8**			
16.	Differential equations of bending of isotropic sandwich panels	3	C	2	1
17.	Differential equations of buckling of isotropic sandwich panels	2	C	2	1
18.	Wrinkling form of local instability – Only Formulae for analysis	2	C	2	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
19.	Other forms of local instability – Only Formulae for analysis	1	C	2	1
	UNIT V: DESIGN OF SANDWICH PANELS	**10**			
20.	Theory of design of sandwich panels	2	C	2	1
21.	Design of Sandwich panels with Simply supported edge for large deflection	2	C	2	1
22.	Design of Sandwich panels with Simply supported edge for Initial deformations	1	C	2	1
23.	Design of sandwich beams	2	D	3	1
24.	Design of sandwich Struts	2	D	3	1
25.	Design of sandwich panels	1	D	3	1
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	David Randal and Steve Lee, "*The Polyurathanes Book*"-, JOHN WILEY, LTD, November, 2002
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Howard G.Allen, "*Analysis and design of structural sandwich panels*" – First edition, PERGAMON PRESS, 1969.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE457E	BRIDGE ENGINEERING	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	15CE204
Data Book / Codes/Standards	IS: 456- 2006, IS: 1343- 1980, IRC:06-2014, IRC:112-2011, IRC:21-2010, IRC:82 (Part 1) – section IX – 1999, IRC:82 (Part 2) – Part IX- 1987
Course Category	P PROFESSIONAL ELECTIVE STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting,2016

PURPOSE	To provide an exposure to the essential of bridge engineering with the focus on structural design

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES		
At the end of the course, student will be able			
1.	To study essential of bridge engineering.	a	c	e
2.	To design RCC slab bridges.	a	c	e
3.	To design RCC girder bridges.	a	c	e
4.	To design Prestressed concrete slab and girder bridges.	a	c	e
5.	To design bearings.	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I- BRIDGE ENGINEERING	**8**			
1.	Types of bridges – suitability of different types of bridges for various spans	1	C	1	1,2,3
2.	Segmental bridges – continuous bridges- arch bridges	1	C	1	1,2,3
3.	Cable- suspended bridges	1	C, I	1	1,2,3
4.	Selection of bridge site – approaches	1	C, I	1	1,2,3
5.	Economical span of a typical bridge-	1	C, I	1	1,2,3
6.	Discharge and Linear water way calculations	1	C,D	1	1,2,3
7.	Scour depth	1	C,D	1	1,2,3
8.	IRC formula IRC Specifications for Road Bridges, Standards live loads, other forces on bridges – general design considerations	1	C,D,I	1	1,2,3
	UNIT II - SLAB BRIDGES	**10**			
9.	RCC Slab bridge - Introduction	2	C,D	2	1,2,3
10.	One-way slab bridge	2	C,D	2	1,2,3
11.	Two-way slab bridge	2	C,D	2	1,2,3
12.	Introduction of Pigeaud curves	2	C,D	2	1,2,3
13.	Principles of design of skew bridges	2	C,D	2	,2,3
	UNIT III - RCC GIRDER BRIDGES	**10**			
14.	RCC girder bridges- Introduction	1	C,D	3	1,2,3
15.	Kerbs- diaphragms	1	C,D	3	1,2,3
16.	Various Methods of design of RCC girder	2	C,D	3	1,2,3
17.	Courbon's theory– calculation of maximum bending moment,	2	C,D	3	1,2,3
18.	Calculation of shear- moving loads	2	C,D	3	1,2,3
19.	Design of cross section	2	C,D	3	1,2,3
	UNIT VI - PRESTRESSED CONCRETE GIRDER BRIDGES	**10**			
20.	Introduction about Prestressed concrete bridge- Principles of prestressing- Pre tensioning- Post Tensioning-Advantages of pre stressed concrete slab and girder bridges –	2	C,D	4	1,2,3
21.	Suitable span – Anchorages- End Block	1	C,D	4	1,2,3
22.	Design of slab and beam cross sections for given bending moment,	2	C,D	4	1,2,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
23.	Calculation of shear	2	C,D	4	1,2,3
24.	Calculation of prestressing force,	2	C,D	4	1,2,3
25.	Eccentricity (analysis of bridges need not be repeated)	1	C,D	4	1,2,3
	UNIT V - DESIGN OF BEARINGS	**7**			
26.	Introduction about Bearings- Forces of bearings- Types of bearings	2	C,D	5	1,2,3
27.	Design of Neoprene bearings	2	C,D	5	1,2,3
28.	Introduction about steel rocker bearing	1	C,D	5	1,2,3
29.	Design of steel rocker bearings	2	C,D	5	1,2,3
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Johnson Victor .D, "*Essentials Of Bridge Engineering*", 6/E, Oxford & IBH Publishing Company Pvt. Ltd., Fourth edition, 2007.
2.	Krishna Raju .N, "*Design of Bridges*", Oxford & IBH Publishing Company Pvt. Ltd., Fourth edition, 2010.
3.	Jagadeesh .T.R, Jayaram .M.A, "*Design Of Bridge Structures*", Prentice – Hall of India Pvt. Ltd., 2006.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Ponnuswamy .S, "*Bridge Engineering*, 2nd E, Tata McGraw Hill", 2008.
5.	Conference Proceedings, *'Advances and Innovations in Bridge Engineering'*, IIT, Madras and Indian Institute of Bridge Engineers, Tamilnadu, Allied Publisher, New Delhi, 1999.
6.	IS: 456- 2000," *Code of Practice for Plain and Reinforced Concrete*", BIS, New Delhi, 2008.
7.	IS: 1343- 2012, "*IS Code of Practice for Prestressed Concrete*", BIS, New Delhi,2012.
8.	IRC:06-2014, "*Code of practice for road bridge", Section – II, Loads and stresses,* Indian Road Congress, New Delhi,2014
9.	IRC:112-2011," *Code of Practice for Concrete Road Bridges*", Indian Road Congress, New Delhi, 2011.
10.	IRC:21-2010, "*Standard Specifications and Code of Practice for Road Bridges*", Section III Cement concrete (Plain and Reinforced), Indian Road Congress, New Delhi, 2000.
11.	IRC:82 (Part 2) – Part IX- 1987, "*Standard Specifications and Code of Practice for Road Bridges*", Elastomeric Bearings, IRC, 1987.
12.	IRC:82 (Part 1) – section IX – 1999, "*Standard Specifications and Code of Practice for Road Bridges*", Metallic Bearings, IRC, 1999.

Course nature						Theory	
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
	End semester examination Weightage:						**50%**

			L	T	P	C
15CE458E	**FORENSIC CIVIL ENGINEERING**		**3**	**0**	**0**	**3**

Co-requisite:	NIL	
Prerequisite:	15CE203	
Data Book / Codes/Standards	NIL	
Course Category	P PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering	
Approval	32nd Academic Council Meeting , 2016	

PURPOSE	To introduce the various aspects of investigation involved in failure of structures	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able		
1.	To impart knowledge of various testing methods of Failed Structures.	b
2.	To learn about aspects of failures connected with various structural systems and materials.	a
3.	To impart knowledge about foundation failures.	e
4.	To know about strategic measures against failures.	e
5.	To gain insight into previous structural failures.	e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: TESTING OF FAILURES	**9**			
1.	Introduction to various methods of testing of failed structures	2	C	1-5	1
2.	Usage of techniques such as laser scanning and microscope for investigation of failed structures	2	C	1-5	1
3.	Radio graphic evaluation of failures	2	C	1-5	1
4.	Load Testing of shoring systems	2	I	1-5	1
5.	Repair technology used for failed structures	1	I	1-5	1
	UNIT II: STRUCTURAL FAILURES	**9**			
6.	Failure of construction materials such as steel and concrete and failure of bolted and welded joints	2	C	2	1
7.	Failure of compression members by reversal of loads	1	C	2	1
8.	Failure of tension members by reversal of loads	1	C	2	1
9.	Failure aspects of post tensioned concrete systems and precast buildings	2	C	2	1
10.	Failure aspects of space frame and plane frame	1	C	2	1
11.	Study of reasons for failure of bridges	2	C	2	1
	UNIT III: GEOTECHNICAL FAILURES	**8**			
12.	Soil liquefaction in cohesive and cohesionless soil	2	C	3	1
13.	Failure of shallow foundation systems in different types of soil	2	C	3	1
14.	Failure of deep foundation systems in different types of soil	2	C	3	1
15.	Causes and remedial measures for failure	2	C	3,4	1
	UNIT IV: DESIGNING AGAINST FAILURE	**8**			
16.	Quality control as a measure for failure control	2	C	4	1
17.	Material selection parameters for failure prevention	1	C	4	1
18.	Workmanship parameters and care against failure	2	C	4	1
19.	Importance of design and detailing in preventing the failures of buildings	3	D	4	1
	UNIT V: CASE STUDIES AND	**11**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	PROFESSIONAL PRACTICE				
20.	Case Studies on famous failures in India	2	C	5	1
21.	Case Studies on famous failures from abroad	2	C	5	1
22.	Reasons of various types of failures	2	C	5	1,3
23.	Lessons learnt from various types of failures	2	C	5	1,3
24.	Aspects of professional practice to safeguard against failure	3	C	5	1
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Kenneth and L. Carper, "*Forensic Engineering*", 2nd Edition, CRC Press, 2001.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	*"Forensic Engineering – 2012"*, proceedings of sixth ASCE Conference of Forensic Engineering held in San Francisco, California, Oct 31- Nov 03, 2013.
3.	Raikar, R.N., "*Learning from failures – Deficiencies in Design, Construction and Service*", R&D Centre (SDCPL), Raikar Bhavan, 1987.

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE459E	DESIGN OF MACHINE FOUNDATION	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	IS:2974-1982, Part 1, IS:2974-1980, Part 2 IS:2974-1979, Part 4, IS 1893: 2002, (Part 1)
Course Category	P PROFESSIONAL ELECTIVE STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting, 2016

PURPOSE	To familiarize with fundamental of structural dynamics and apply the same to design of foundations for different types of machines

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES		
At the end of the course, student will be able to				
1.	Introduce fundamentals of free vibration	a	c	e
2.	Provide exposure to forced vibration and vibration isolation	a	c	e
3.	Design foundation for reciprocating machines	a	c	e
4.	Design foundation for hammers	a	c	e
5.	Design foundation for low frequency rotary machines	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: UNIT I – FUNDAMENTALS OF FREE VIBRATION	9	C, I	1	1
1.	Undamped free vibration analysis of Single degree of vibration using D' Alembert principle	2	C, I	1	1
2.	Damped Free vibration analysis of Single degree of vibration using D' Alembert principle	2	C, I	1	1
3.	Determination of forces due to free vibration	2	C, I	1	1
4.	Modal analysis for lumped mass modeling for two degree of freedom system	3	C, I	1	1
	UNIT II: FUNDAMENTALS OF FORCED VIBRATION	9			
5.	Response of single degree freedom system to forced harmonic loading	3	C, I	2	1
6.	Vibration isolation , resonance and dynamic amplification factor of single degree freedom system	2	C, I	2	1
7.	Response spectrum analysis of 2 mass system using modal analysis	3	C, I	2	1,5
8.	Shock spectrum	1	C, I	2	1
	UNIT III: FOUNDATION FOR RECIPROCATING MACHINES	9			
9.	Determination of unbalanced portion of periodic inertia forces	2	C, I	3	2, 3, 4, 6
10.	Concepts of degrees of freedom in reciprocating machines	1	C, I	3	2, 3, 4, 6
11.	Design data required for machine & soil	1	D, I	3	2, 3, 4, 6
12.	Static design criteria	1	D, I	3	2, 3, 4, 6
13.	Dynamic design criteria	1	D, I	3	2, 3, 4, 6
14.	RCC foundation design for reciprocating machines	2	D,	3	2, 3, 4, 6

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
			I		
15.	Construction Techniques for machine foundation	1	I	3	2, 3, 4, 6
	UNIT IV:FOUNDATION FOR HAMMERS	**9**			
16.	Types of foundation support and influence of coefficient of restitution	1	C	4	2, 3, 4, 7
17.	Design data and soil parameters	1	D	4	2, 3, 4, 7
18.	Details of hammer and cushioning pad	1	D	4	2, 3, 4, 7
19.	Design criteria and permissible stress	1	D	4	2, 3, 4, 7
20.	Dimensions and mass- two mass system – vibration analysis	2	D, I	4	2, 3, 4, 7
21.	Design of foundation	2	D	4	2, 3, 4, 7
22.	Construction Techniques for hammer foundation	1	I	4	2, 3, 4, 7
	UNIT V: FOUNDATION FOR ROTARY MACHINES	**9**			
23.	Definition of low frequency rotary machines	1	C		2, 3, 4, 8
24.	Typical foundation details for pumps, motor generators, rolling mills	2	C		2, 3, 4, 8
25.	Design data on soil parameters and machines	1	D		2, 3, 4, 8
26.	Design criteria and principles of design	1	D		2, 3, 4, 8
27.	Analysis for static and dynamic loads	3	I		2, 3, 4, 8
28.	Construction techniques for foundation of rotary machines	1	I		2, 3, 4, 8
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Anil K.Chopra, "*Dynamics of structures*" (*Theory and Applications to Earthquake Engineering)*, 2nd Edition, Prentice Hall of India Private Limited. New Delhi, 2003.
2.	Dayaratnam, P., "*Design of Reinforced Concrete Structures*", 4th edition, Oxford &IBH-Pubs Company-NEW DELHI,2011
3.	Srinivasulu.P, Vaidyanathan .C.V, "*Handbook Of Machine Foundations*", McGraw-Hill, 1977.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Shamsher Prakash, Vijay Kumar Puri, "*Foundations for machines: analysis and design*", Wiley, 1988.
5.	IS 1893: 2002, (Part 1) "*Criteria for Earthquake Resistant Design of Structures - Part 1 : General Provisions and Buildings*", BIS, 2002.
6.	IS:2974-1982, Part 1, "*Code of practice for design and construction of machine foundations: Part 1 Foundation for reciprocating type machines*", BIS, 1982.
7.	IS:2974-1980, Part 2, "*Code of practice for design and construction of machine foundations: Part 2 Foundations for impact type machines*" (*hammer foundations)*, BIS, 1980.
8.	IS:2974-1979, Part 4, "*Code of practice for design and construction of machine foundations: Part 4 Foundations for rotary type machines of low frequency*", BIS, 1979.

Course nature			Theory			
Assessment Method						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**
End semester examination Weightage : 50%						

15CE460E		REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To provide a comprehensive knowledge on the diagnosis, assessment and material application relating to maintenance and rehabilitation of structures.			
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able				
1.	To provide an overview of performance of concrete structures	a	c	e
2.	To assess the diagnosis of distress	a	c	e
3.	To assess the extent of distress	a	c	e
4.	To choose the appropriate material and its application	a	c	e
5.	To study strengthening and demolition of structural components	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: GENERAL ASPECTS	**9**			
1.	Performance of construction materials and components in services for strength permeability	2	C	1	1,2,4
2.	Thermal properties and cracking effects due to climate, temperature, chemicals, wear and erosion	3	C	1	1,2,4
3.	Design and construction errors	3	C	1	1,2,4
4.	Effects of cover thickness	1	C	1	1,2,4
	UNIT II: MAINTENANCE AND DIAGNOSIS OF FAILURE	**9**			
5.	Definitions : Maintenance, Repair and rehabilitation	1	C	2	6
6.	Facets of Maintenance, Importance of Maintenance	2	C	2	1,2,3,4,5
7.	Preventive measures based on various aspects of inspection	2	C	2	1,2,3,4,5
8.	Assessment procedure for evaluating a damaged structure	2	C	2	1,2,3,4,5
9.	Diagnosis of construction failures.	2	C	2	1,2,3,4,5
	UNIT III: DAMAGES AND THEIR REMEDIES	**9**	C		
10.	Corrosion damage of reinforced concrete, methods of corrosion protection	3	C	2,3	2,4,5,6,7
11.	Corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, rust eliminators	2	C	2,3	2,4,5,6,7
12.	Causes of deterioration of concrete, steel, masonry and timber structures	2	C	2,3	2,4,5,6,7
13.	surface deterioration, efflorescence, causes, prevention and protection.	2	C	2,3	2,4,5,6,7
	UNIT IV: MATERIALS AND TECHNIQUES OF REPAIR	**9**			
14.	Special concrete and mortar, concrete chemicals, expansive cement	2	C	4	1,2,4,5,6,7
15.	Polymer concrete sulphur infiltrated concrete	2	C	4	1,2,4,5,6,7
16.	Ferro cement, fiber reinforced concrete	2	C	4	1,2,4,5,6,7

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
17.	Methods of repair in concrete, steel, masonry and timber structures	2	C	4	1,2,4,5,6,7
18.	Guniteand shotcrete, expoxy injection	1	C	4	
	UNIT V: STRENGTHENING AND DEMOLITION ASPECT	**9**	C		
19.	Strengthening of existing structures	1	C	5	2,4,5,6,7
20.	Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure	2	C	5	2,4,5,6,7
21.	Use of non destructive testing techniques for evaluation	2	C	5	2,4,5,6,7
22.	Load testing of structure using IS codal provisions - Demolition of structures using engineered and non engineered techniques	2	C	5	2,4,5,6,7
23.	Case studies	2	C	5	2,4,5,6,7
Total contact hours		**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Shetty .M.S, "*Concrete, Technology, Theory and Practice*", S.Chand and Company, New Delhi 2005.
2.	Raiker .R.N, "*Learning from Failures, Deficiencies in Design, Construction and Service*", - R&D Centre (SDCPL), RaikarBhavan, Bombay 1987.
3.	Krishna Raju N, "*Prestressed Concrete*", Tata Mcgraw hill publishing Company Limited, New Delhi, 1981.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	"*Repair & Rehabilitation*", Compilation from The Indian Concrete Journal,– ACC – RCD Publication 2001.
5.	"*Health Monitoring of Structures – A Proactive strategy*"–proceedings of the ISTE sponsored short course", organized by the Department of Civil Engineering, S.R.M.Engineering College, S.R.M.Nagar, January 2003.
6.	Campbell-Allen, D, Harold Roper, "*Concrete Structures Materials Maintenance and Repair*"Longman Scientific and Technical UK 1991.
7.	Allen .R.T, and Edwards .S.C, Shaw .D.N, "*Repair of Concrete Structures*", Chapman and Hall, 2005.

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE461E	DESIGN OF EARTHQUAKE RESISTANT STRUCTURES		L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	IS 1893: 2002, (Part 2), IS 13920: 1993					
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting, 2016					

PURPOSE	To enable students to acquire knowledge on the fundamentals structural dynamics and their application to the design of earthquake resistant structures			
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**		
At the end of the course, student will be able to				
1.	Understand the principles of vibration with regard to single degree of freedom system.	a	c	e
2.	Carry our dynamic analysis of moment resistant frames.	a	c	e
3.	Determine the design lateral forces by means of codal provisions.	a	c	e
4.	Introduce the concept of ductility and corresponding detailing.	a	c	e
5.	Expose the students to base isolation techniques earthquake induced damages.	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: SINGLE DEGREE OF FREEDOM SYSTEM (SDOF)	9			
1.	Introduction to Systems with single degree of freedom	1	C	1	1
2.	Equation of motion of SDOF and its solution	2	I	1	1
3.	Analysis of free vibrations damped and undamped	2	I	1	1
4.	Response to harmonic, impulsive, periodic and general dynamic loading	3	I	1	1
5.	Analysis SDOF systems with ground motion (earth quake loads)	1	I	1	1
	UNIT II: MULTI-DEGREE OF FREEDOM SYSTEM (MDOF)	9			
6.	Modeling of shear frames up to 2 degree of freedom system	1	C	2	1,2
7.	Modal analysis for free vibration	3	I	2	1,2
8.	Modal analysis for forced vibration with harmonic loading and determination of nodal forces from first principles	5	I	2	1,2
	UNIT III: DESIGN SEISMIC FORCES	9			
9.	Codal provisions for design as per IS 1893-2002	1	C	3	2,8
10.	Concept of response spectrum and procedure for constructing the response spectrum	1	C, I	3	2,8
11.	Determination of lateral forces – base shear – by response spectrum method for 2 storey moment resistant frames	2	I	3	2,8
12.	Calculation of drift and top storey lateral deflection	1	I	3	2,8
13.	Aspects in planning and layout for regular and irregular buildings in plan and elevation	1	C, I	3	2,8
14.	Mass and stiffness irregularity	1	I	3	2,8
15.	Calculation of centre of mass and centre of rigidity for simple layouts.	1	I	3	2,8

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
16.	Computation of eccentricity and torsion in irregular building s	1	I	3	2,8
	UNIT IV:DETAILING FOR DUCTILITY	**9**			
17.	Definition of Ductility	1	C	4	2,8,9
18.	General Codal provisions for ductility detailing as per IS :13920-1993	1	D, I	4	2,8,9
19.	Codal provisions for ductility detailing as per IS :13920-1993 for columns	2	D, I	4	2,8,9
20.	Codal provisions for ductility detailing as per IS :13920-1993 for beams	1	D, I	4	2,8,9
21.	Codal provisions for ductility detailing as per IS :13920-1993 for foundation	1	D, I	4	2,8,9
22.	Shear wall design and detailing as per IS :13920-1993	3	D, I	4	2,8,9
	UNIT V: SPECIAL TOPICS	**9**			
23.	Concept of seismic damage ratings	1	C	5	3,4,5,6,7
24.	Repair and Rehabilitation techniques and seismic strengthening	1	I	5	3,4,5,6,7
25.	Case studies in repair and rehabilitation	2	I	5	3,4,5,6,7
26.	Passive control of vibration using base isolation techniques	1	I	5	3,4,5,6,7
27.	Properties of base isolators and modeling procedure of base isolators using SAP and ETABS	1	I	5	3,4,5,6,7
28.	Active control of vibration	2	C	5	3,4,5,6,7
29.	New and favorable materials to resist seismic forces	1	D	5	3,4,5,6,7
	Total contact hours		**45**		

Sl.No.	LEARNING RESOURCES
	TEXT BOOKS
1.	Anil K.Chopra, "*Dynamics of structures" (Theory and Applications to Earthquake Engineering)*, 2nd Edition, Prentice Hall of India Private Limited. New Delhi, 2003.
2.	Short course on "*Seismic design of reinforced concrete buildings*", CEP, IIT, Kanpur, 2005.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Short term course on "*Seismic Retrofit of Multistoreyed Reinforced concrete Buildings*", National Programme on Earthquake Engineering Education (NPEEE), IIT, Madras, July, 2005.
4.	Paulay.T and Priestly. M.N.J, "*Aseismic Design of Reinforced Concrete and Masonry Building*", John Wiley and Sons, 1991.
5.	Course Notes on "*Structural Design for Dynamic Loads*", SRM Engineering College, Dec2002.
6.	Lecture notes on "*Health Monitoring of Structures- A Proactive Strategy*", ISTE sponsored course held at SRM Engineering College, Jan,2003.
7.	Damodarasamy, S.R., S.Kavitha, "*Basic Structural dynamics and Aseismic Deign*", PHI Learning (Pvt)New Delhi. 2014.
8.	*"Learning earthquake Design and Construction"*, Earthquake Tips 1 to 24, Authored by C.V.R. Murthy, IIT, Kanpur. eqtips@iitk.ac.in Web sites: www.nicee.org.
9.	IS 1893: 2002, (Part I) "*Criteria for Earthquake Resistant Design of Structures - Part 1 :General Provisions and Buildings*", BIS, New Delhi, 2002.
10.	IS 13920: 1993 ,"*Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice*", Reaffirmed,2003, BIS, New Delhi, 2003

Course nature		Theory				
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**
End semester examination Weightage : 50%						

15CE462E		CONCRETE TECHNOLOGY	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32ⁿᵈAcademic Council Meeting , 2016

PURPOSE	To gain theoretical knowledge on concrete materials, admixtures used in concrete, fresh concrete, hardened concrete and durability properties of concrete and the respective technologies

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES	
At the end of the course, student will be able to			
1.	Gain knowledge about concrete materials and their properties	a	
2.	Understand the role of different admixtures in concrete	a	
3.	Know the concept on fresh concrete properties and its testing procedures	a	b
4.	Obtain knowledge on hardened concrete properties and their testing procedures	a	b
5.	Understand the aspects of durability properties of concrete and their testing procedures	a	b

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: CONCRETE MATERIALS	**9**			
1.	Cement and its chemical composition, Bogue's Compound, Hydration of cement, Heat of hydration and water requirement for hydration.	2	C	1	1,2,3,4
2.	Conventional aggregates and its formation types, size and limitations, shape and classification.	1	C	1	1,2,3,4
3.	Strength tests on aggregates, crushing, impact , abrasion , density and specific gravity, water absorption and moisture content	3	C	1	1,2,3,4
4.	Grading of aggregates and sieve analysis.	1	C	1	1,2,3,4
5.	Lightweight aggregate and its types, artificial and natural aggregate, coconut shell, oil palm shell and palm kernel shell.	1	C	1	1,2,3,4
6.	Quality and quantity of water for concrete	1	C	1	1,2,3,4
7.	**UNIT II: ADMIXTURES**	**9**			
8.	Admixtures and additives, chemical admixtures	1	C	2	1,2,3,4
9.	Plasticizers and its effects in concrete	1	C	2	1,2,3,4
10.	Super plasticizers and its effects in fresh and hardened properties of concrete	2	C	2	1,2,3,4
11.	Accelerators, retarders and water proofers.	2	C	2	1,2,3,4
12.	Mineral admixtures, Fly ash, Silica fume, GGBS andMetakaolin	2	C	2	2,3,4
13.	Effects of mineral admixtures on concrete properties and its uses	1	C	2	2,3,4
	UNIT III: FRESH CONCRETE	**9**			
14.	Fresh concrete, workability and its significance, factors affecting workability and its measurement	1	C,I	3	1,2,3,4
15.	Vee Bee consistometer, flow test, kelly ball test.	2	C,I	3	1,2,3,4
16.	Segregation and its condition, remedies for	1	C,I	3	1,2,3,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	segregation				
17.	Bleeding and its effects, test for bleeding	1	C	3	1,2,3,4
18.	Process of manufacture of concrete, batching, mixing, transporting, placing, compaction, curing and finishing of concrete.	3	D	3	1,2,3,4
19.	Underwater concrete.	1	C	3	1,2,3,4
	UNIT IV: HARDENED CONCRETE	**9**			
20.	Hardened concrete and compression test on hardened concrete	1	C,I	4	1,2,3,4
21.	Factors affecting strength and failure due to compression	1	C,I	4	1,2,3,4
22.	Flexural strength tests	2	C,I	4	1,2,3,4
23.	Stress –strain curve for concrete and test for modulus of elasticity of concrete	2	C,I	4	1,2,3,4
24.	Different elastic moduli	1	C,I	4	1,2,3,4
25.	Creep and its measurement, factors affecting creep, effects of creep on concrete	1	C	4	1,2,3,4
26.	Shrinkage and its classifications, factors	1	C	4	1,2,3,4
	UNIT V: DURABILITY OF CONCRETE	**9**			
27.	Definition for durability, significance and impact of W/C ratio	2	C	5	1,2,3,4
28.	Permeability and higher permeability in actual structures.	1	C,I	5	1,2,3,4
29.	Joints in concrete and their categories	1	C	5	3
30.	Concrete subjected to high temperature, fire resistance, freezing and thawing.	2	C	5	1,2,3,4
31.	Concrete in sea water. Carbonation, rate of carbonation and measurement of depth of carbonation.	3	C	5	1,2,3,4
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Neville, A.M. *Properties of Concrete*, Fifth Edition, Pearson, 2011.
2.	Shetty, M.S. *Concrete Technology, Theory and Practice*, S. Chand & Company, New Delhi, 2013.
3.	A.R. Santhakumar, Concrete Technology, 2009 Edition, Oxford University Press
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Kumar Mehta Paulo,P and Monteiro, J.M. Concrete Microstructure, Properties and Materials.Fourth Edition, McGraw Hill Education, 2006, copy right ©2014.
5.	IS 269: 1989, Indian Standard Specification for ordinary Portland cement, 33 grade, 1998.
6.	IS 383: 1970, Indian Standard Specification for coarse and fine aggregates from natural sources for concrete, 1997.
7.	IS 456:2000, Indian Standard Specification for code of practice for plain and reinforced concrete, 2000
8.	IS 516: 1959, Indian Standard Specification for method of test for strength of concrete.
9.	IS 1199: 1959, Indian Standard Specification for methods of sampling and analysis of concrete.
10.	IS 2386 (Part 1):1963, Indian Standard Specification for methods of test for aggregates for concrete Part 1 Particle size and shape, 1997.
11.	IS 2386 (Part 4):1963, Indian Standard Specification for methods of test for aggregates for concrete Part 4 Mechanical Properties, 1997.
12.	IS 3085: 1965, Indian Standard Specification for methods of test for permeability of cement

13.	IS 3812: 1981, Indian Standard Specification for fly ash for use as a pozzolana and admixture.
14.	IS 6461 (Part 7): 1973, Indian Standard Specification for glossary of terms relating to cement concrete: mixing, laying, compaction, curing and other construction aspects.
15.	IS 6461 (Part 8): 1973, Indian Standard Specification for glossary of terms relating to cement concrete: Properties of concrete.
16.	IS 8112: 1989, Indian Standard Specification for 43 grade ordinary Portland cement, 2000.
17.	IS 9013: 1978, Indian Standard Specification for method of making, curing and determining compressive strength cured concrete test specimen.
18.	IS 10510: 1983, Indian Standard Specification for Vee Bee consistometer.
19.	IS 12269: 1987, Indian Standard Specification for 53 grade ordinary Portland cement, 1999.
20.	ASTM C330, Standard Specification for lightweight aggregates for structural concrete, Annual Book of ASTM Standards.

(top of table, continued from previous page): mortar and concrete.

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE463E		SPECIAL CONCRETES	L	T	P	C
			3	0	0	3

Co-requisite:	NIL		
Prerequisite:	NIL		
Data Book / Codes/Standards	NIL		
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	To acquire theoretical knowledge on special concretes, lightweight, high density, fibre reinforced, ferrocement, polymer and geo-polymer, self-compacting and other concretes.

INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**	
At the end of the course, student will be able to		
1.	Gain knowledge about lightweight and high density concretes	a	
2.	Obtain knowledge about fibre reinforced concrete and ferrocement	a	
3.	Gain knowledge about polymer and geo-polymer concretes	a	
4.	Have familiarity with concepts about self-compacting concrete	a	b
5.	Know and gain knowledge about some of the other types of concretes	a	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
1.	**UNIT I: LIGHTWEIGHT AND HIGH DENSITY CONCRETE**	**9**			
2.	Lightweight concrete, its classification and its advantages	1	C	1	2,3,4
3.	Natural and artificial lightweight aggregate	1	C	1	2,3,4
4.	Requirements for aggregates for structural concrete.	1	C	1	2,3,4
5.	Effects of water absorption by lightweight aggregate.	1	C	1	2,3,4
6.	Aspects of fresh state and strength of lightweight aggregate	1	C	1	2,3,4
7.	Aggregate-matrix bond, Elastic properties and durability properties.	1	C	1	2,3,4
8.	Methods to make lightweight concrete ,Cellular , aerated and no fines concrete concrete.	1	C	1	2,3,4
9.	Uses of High Density concrete and types of radiation	1	C	1	2,3,4
10.	Shielding ability and concrete for radiation shielding.	1	C	1	2,3,4
	UNIT II: FIBRE REINFORCED AND FERROCEMENT	**9**			
11.	Basic requirements and properties of Fiber Reinforced Concrete	1	C	2	1,2,3,
12.	Factors affecting FRC , Orientation , volume fraction and aspect ratio.	1	C	2	1,2,3,
13.	Type of fibres and effects of fibre in concrete.	1	C	2	2,3,4
14.	Types of FRC	2	C	2	2,3,4
15.	Benefits ,applications and current development in FRC.	1	C	2	2,3,4
16.	Casting and curing of FRC, itsadvantages and		C,I		

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	applications.				
17.	Materials of ferrocement	1	C,I	2	2,3,4
18.	Mixing ,casting techniques and applications	1	C,I	2	1,2,3,4
	UNIT III: POLYMER AND GEO-POLYMER CONCRETE	**9**			
19.	Polymer concrete and its types	1	C	3	2,3,4
20.	Polymer Impregnated Concrete	1	C	3	2,3,4
21.	Polymer Cement Concrete and Polymer concrete	2	C	3	2,3,4
22.	Partially impregnated and surface coated polymer concrete , its advantages and its applications	2	C	3	2,3,4
23.	Geo-polymer concrete and Reduction of cement consumption	1	C	3	2,3,4
24.	Casting, curing and Properties of geo-polymer	1	C	3	2,3,4
25.	Economics benefits , advantage and application of geo-polymer.	1	C	3	2,3,4
	UNIT IV: SELF COMPACTING CONCRETE	**9**			
26.	Self Compacting Concrete , its benefit and materials of SCC	1	C	4	2,3,4
27.	Mineral admixtures and SCC mixes	1	C	4	2,3,4
28.	Characteristics and workability requirement	1	C	4	2,3,4
29.	Mix design, production and placing of SCC	2	C	4	2,3,4
30.	Test methods including slump flow ,V – funnel test , L-box test ,U-box test and fill box test	3	C	4	2,3,4
31.	Complexities involved in making SCC and Indian Scenario of SCC.	1	C	4	2,3,4
	UNIT V: OTHER CONCRETES	**9**			
32.	SIFCON, its composition and process of making SIFCON	1	C	5	2,3,4
33.	Design Principle , Factors, Advantage, disadvantage and application	1	D	5	2,3,4
34.	Gunite , shotcrete , advantages, limitation s and its use	1	C	5	2,3,4
35.	dry and wet process and its advantage	1	C	5	2,3,4
36.	Pre-packed concrete , its advantages and essential requirements	1	C	5	2,3,4
37.	Vacuum concrete , general arrangement and rate of extraction of water	1	C	5	2,3,4
38.	Sulphur infiltrated concrete and its applications	1	C,I	5	2,3,4
39.	Cold weather concreting , its effects and precautions to be carried out	1	C	5	2,3,4
40.	Hot weather concreting ,problems associated with it and precautions to be carried out. Concrete based on waste materials usingRecycled aggregate,coconut shell, palm shell. etc.	1	C	5	2,3,4
	Total contact hours	**45**			

	LEARNING RESOURCES
Sl. No.	**TEXT BOOKS**
1.	Neville, A.M. '*Properties of Concrete'*, Fifth Edition, Pearson, 2011.
2.	Shetty, M.S. '*Concrete Technology, Theory and Practic'e*, S. Chand & Company, New Delhi, 2013.
3.	A.R. Santhakumar, '*Concrete Technology'*, 2009 Edition, Oxford University Press
	REFERENCE BOOKS/OTHER READING MATERIAL

| 4. | Kumar Mehta Paulo,P and Monteiro, J.M. '*Concrete Microstructure, Properties and Material's*.Fourth Edition, McGraw Hill Education, 2006, copy right ©2014. |
| 5. | EFNARC, '*Specification and Guidelines for Self-Compacting Concrete'*, ISBN 0 9539733 44, February 2002. |

Course nature				Theory			
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weight age :		**50%**

15CE464E		CONCRETE TESTING TECHNIQUES		L	T	P	C
				3	0	0	3
Co-requisite:	NIL						
Prerequisite:	NIL						
Data Book / Codes/Standards	NIL						
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING				
Course designed by	Department of Civil Engineering						
Approval	32nd Academic Council Meeting , 2016						

PURPOSE	To gain knowledge on various tests to be conducted on cement, aggregate and concrete		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Gain knowledge about cement tests	a	b
2.	Obtain knowledge about aggregate tests	a	b
3.	Be Familiar with various tests on fresh concretes	a	b
4.	Be thorough about hardened concrete tests	a	b
5.	Have knowledge about some of the other types of concretes	a	b

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: CEMENT TESTS	**9**			
1.	Cement and its types	2	C,I	1	1,2,3,4
2.	Tests on cement, Field tests before and after open of bag. .	1	C,I	1	1,2,3,4
3.	Laboratory tests, Fineness test, sieve test and air-permeability test	1	C,I	1	1,2,3,4
4.	Consistency test, setting time tests procedure and precautions.	2	C,I	1	1,2,3,4
5.	Soundness test, Strength test and precautions	1	C,I	1	1,2,3,4
6.	Specific gravity test and precaution	1	C,I	1	1,2,3,4
7.	Hydration test for cement	1			
	UNIT II: AGGREGATE TESTS	**9**			
8.	Aggregates and its types, classifications	1	C,I	2	1,2,3,4
9.	Mechanical properties, strength, crushing value test, Aggregate 10 % fines value and impact value test	1	C,I	2	1,2,3,4
10.	Abrasion test and methods, bulk density and specific gravity test	1	C,I	2	1,2,3,4
11.	Absorption and moisture content, bulking of aggregates, cleanliness	2	C,I	2	1,2,3,4
12.	Soundness tests, flakiness index and elongation index	1	C,I	2	1,2,3,4
13.	Grading of Aggregates and sieve analysis	1	C,I	2	1,2,3,4
14.	Tests for finding clay, fine silt, fine dust and organic impurities	1	C,I	2	1,2,3,4
15.	Alkali Aggregate reaction	1	C,I	2	1,2,3,4
	UNIT III: FRESH CONCRETE TESTS	**9**			
16.	Fresh concrete, workability and tests for workability	1	C,I	3	1,2,3,4
17.	Slump cone test and compaction factor test	2	C,I	3	1,2,3,4
18.	Flow test, Kelly ball test and Veebeeconsistometer	2	C,I	3	1,2,3,4
19.	Segregation and test for bleeding of concrete	2	C,I	3	1,2,3,4
20.	Setting time of concrete	1	C,I	3	1,2,3,4
21.	Air entrainment test, fresh concrete density and	1	C,I	3	1,2,3,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	demoulded density				
	UNIT IV: HARDENED CONCRETE TESTS	**9**			
22.	Strength of concrete, water / cement ratio and gel / space ratio	1	C,I	4	1,2,3,4
23.	Accelerated curing test, compressive strength test, UPV and rebound hammer test	2	C,I	4	1,2,3,4
24.	Flexural strength test by central point load and third point load tests	1	C,I	4	1,2,3,4
25.	Split tensile test and impact test	1	C,I	4	1,2,3,4
26.	Elastic property of concrete test and Poisson's ratio	1	C,I	4	1,2,3,4
27.	Measurement of creep of concrete and test for shrinkage of concrete	2	C,I	4	1,2,3,4
28.	Bond test between concrete and steel	1	C,I	4	1,2,3,4
	UNIT V: DURABILITY TESTS	**9**			
29.	Water absorption and volume of permeable pore voids	1	C,I	5	1,2,3
30.	Test on Sorptivity	1	C,I	5	1,2
31.	Rapid chloride penetration test, acid and sulphate resistance tests	1	C,I	5	1,2,3,4
32.	Salt ponding test	1	C,I	5	1,2,3,4
33.	Elevated temperature resistance test	1	C,I	5	1,2,3,4
34.	Freezing and thawing	1	C,I	5	1,2,3,4
35.	Carbonation and its measurements, phenolphthalein test	1	C,I	5	1,2,3.4
36.	Corrosion of steel	1	C,I	5	1,2,3,4
37.	Surface treatments of concrete	1	C,I	5	1,2,3,4
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Neville, A.M. "*Properties of Concret"e*, Fifth Edition, Pearson, 2011.
2.	Shetty, M.S. "*Concrete Technology, Theory and Practic"e*, S. Chand & Company, New Delhi, 2013.
3.	A.R. Santhakumar, "*Concrete Technology"*, 2009 Edition, Oxford University Press
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Kumar Mehta Paulo,P and Monteiro, J.M. "*Concrete Microstructure, Properties and Materials"*.Fourth Edition, McGraw Hill Education, 2006, copy right ©2014.
5.	IS 269: 1989, Indian Standard Specification for ordinary Portland cement, 33 grade, 1998.
6.	IS 383: 1970, Indian Standard Specification for coarse and fine aggregates from natural sources for concrete, 1997.
7.	IS 516: 1959, Indian Standard Specification for method of test for strength of concrete.
8.	IS 1199: 1959, Indian Standard Specification for methods of sampling and analysis of concrete.
9.	IS 2386 (Part 1):1963, Indian Standard Specification for methods of test for aggregates for concrete Part 1 Particle size and shape, 1997.
10.	IS 2386 (Part 2):1963, Indian Standard Specification for methods of test for aggregates for concrete Part 2 Estimation of deleterious materials and organic impurities, 1997.
11.	IS 2386 (Part 3):1963, Indian Standard Specification for methods of test for aggregates for concrete Part 3 Specific gravity, density, voids, absorption and bulking, 1997.
12.	IS 2386 (Part 4):1963, Indian Standard Specification for methods of test for aggregates for concrete Part 4 Mechanical Properties, 1997.
13.	IS 3085: 1965, Indian Standard Specification for methods of test for permeability of cement mortar and concrete.

14.	IS 4031(Part 9): 1988, Indian Standard Specification for methods of physical tests for hydraulic cement: Determination of heat of hydration
15.	IS 4032: 1985, Indian Standard Specification for method of chemical analysis of hydraulic cement.
16.	IS 5816: 1999, Indian Standard Specification for method of test for splitting tensile strength of concrete.
17.	IS 6461 (Part 8): 1973, Indian Standard Specification for glossary of terms relating to cement concrete: Properties of concrete.
18.	IS 8112: 1989, Indian Standard Specification for 43 grade ordinary Portland cement, 2000.
19.	IS 9013: 1978, Indian Standard Specification for method of making, curing and determining compressive strength cured concrete test specimen.
20.	IS 10510: 1983, Indian Standard Specification for Vee Bee consistometer.
21.	IS 12269: 1987, Indian Standard Specification for 53 grade ordinary Portland cement, 1999.
22.	IS:2770(Part 1):1967, Indian Standard Methods of Testing of Bond in Reinforced Concrete. UDC 666-982:620.172.21.
23.	ASTM C78-84, Standard Test Method for Flexural Strength of Concrete, Annual Book of ASTM standards.
24.	ASTM C496-90, Standard Test Method for Splitting Tensile strength Of Cylindrical Concrete Specimens, Annual Book of ASTM Standards
25.	ASTMC C 234, Standard Test Method for Comparing Concrete on the basis of Bond development with Reinforcing Steel, Annual Book of ASTM Standards.
26.	ASTM C1202 – 12, Standard Test Method for Electrical Indication of Concrete Stability to resist Chloride Ion Penetration
27.	ASTM C 642-97 , Standard Test for Density, Absorption and Voids on Hardened Concrete, Annual Book of ASTM Standards

Course nature		Theory					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE465E	DESIGN OF STEEL-CONCRETE COMPOSITE STRUCTURES		L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	15CE303					
Data Book / Codes/Standards	IS : 11384					
Course Category	P	PROFESSIONAL ELECTIVE	STRUCTURAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To bring about an exposure to design of steel -concrete composite structural members				
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**			
At the end of the course, student will be able to					
1.	understand the behavior of steel -concrete composite members and the principle of design of composite beams	a	c	e	
2.	understand the behavior and principle of design of composite slabs and trusses	a	c	e	
3.	understand the behavior and principle of design of composite columns	a	c	e	
4.	know the design of connections	a	c	e	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I-INTRODUCTION	**9**			
1.	Basic Terminology-Advantages of Steel - Concrete Composite Construction	1	C	1	1-6
2.	Types of Composite Structural systems adopted for multi-storied buildings	1	C	1	1-6
3.	General Code provisions	1	C,D,I	1	1-6
4.	Behavior of Composite Structures and structural elements	2	C,I	1	1-6
5.	Composite action in Beams	2	C,I	1	1-6
6.	Design of Composite Beams (principle only)	2	C,D,I	1	1-6
	UNIT II-DESIGN OF COMPOSITE SLABS AND TRUSSES	**9**			
4.	Types-Structural advantages	1	C	2	1-6
5.	Behavior of Composite Slabs	2	C,I	2	1-6
6.	Design principles	2	C,D,I	2	1-6
7.	Behavior of Composite Trusses	2	C,I	2	1-6
8.	Design principles	2	C,D,I	2	1-6
	UNIT III-DESIGN OF COMPOSITE COLUMNS	**9**			
9.	Types-Structural advantages of Composite Columns	2	C	3	1-6
10.	Behavior of Composite Columns	3	C,I	3	1-6
11.	Code provisions	1	C,D,I	3	1-6
12.	Design of Composite Columns(principle only)	3	C,D,I	3	1-6
	UNIT IV-DESIGN OF CONNECTIONS	**9**			
13.	Types of Connections - Basics of Design of Connections in Composite structures	2	C,D	4	1-6
14.	Shear Connections -Types	2	C,D,I	4	1-6
15.	Design procedure	2	C,D,I	4	1-6
16.	Design of Connections in Composite trusses	3	C,D,I	4	1-6
	UNIT V-SEISMIC DESIGN	**9**			
17.	Basics of Seismic analysis and design	1	C	5	1-6
18.	Seismic behavior of Composite structures	2	C	5	1-6
19.	Concepts regarding analysis of Composite	2	C	5	1-6

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	structures				
20.	Design principles and methods	2	C,D,I	5	1-6
21.	Case Studies	2	C,D,I	5	1-6
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Johnson.R.P., "Composite Structures of Steel and Concrete", Blackwell Publishing, 2008.
2.	Oehlers.D.J., Bradford.M.A.,"Composite Steel and Concrete structural members-Fundamental Behavior", Pergaman Pub.,1995.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	"*Teaching Resource Material for Structural Steel Design*" Volume 2/3 jointly prepared by IITM, Chennai, Anna University, Chennai, SERC,CSIR, Chennai and INSDAG, Kolkatta.
4.	Proceedings of STTP on "*Emerging potential of Steel Composites as powerful alternative in construction industry*" organized by Dept. of Civil Engineering, SRM University, Kattankulathur during 01-05 Feb. 2005.
5.	Proceedings of STTP on "*Steel-Concrete Composite Structures*" organized by Dept. of Civil Engineering, SRM University, Kattankulathur during 20-21 Dec. 2007.
6.	IS : 11384-1983, "*Code of Practice for Composite Construction in Structural Steel and Concrete*" (Reaffirmed 2003), BIS, New Delhi, 2003

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

ELECTIVE V

GIS AND REMOTE SENSING

ENGINEERING GEOLOGY

ENVIRONMENTAL ENGINEERING

OFFERED IN

IV YEAR, II SEMESTER

15CE321E	GEOGRAPHICAL INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	DEPARTMENTAL ELECTIVE	GIS AND REMOTE SENSING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To understand the basics and application of GIS					
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**				
At the end of the course, student will be able						
1.	To understand the GIS, background, development and components of GIS	a	d	g	h	i	k
2.	To study the data capturing for GIS techniques and data base management	a	d	g	h	i	k
3.	To study the analysis of various spatial and non-spatial data in GIS	a	d	g	h	i	k
4.	To study the generation DEM and making model	a	d	g	h	i	k
5.	To appreciate the application of GIS	a	d	g	h	i	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I- INTRODUCTION TO GIS	**9**			
1.	Definition of GIS, Historical background	1	C,D	1	1,2
2.	Concepts and Basic Requirements	1	C,D	1	1,2
3.	GIS Softwares	1	C,D	1	1,2
4.	Elements of GIS	1	C,D	1	1,2
5.	Cartography – definition and importance	1	C,D	1	1,2
6.	Map definition - Types	1	C,D	1	1,2
7.	Map Analysis	1	C,D	1	1,2
8.	Coordinate system	1	C,D	1	1,2
9.	Different Coordinate system	1	C,D	1	1,2
	UNIT II: DATA BASE MANGEMENT	**9**			
10.	Introduction – Types of data	1	C,D	2	1,2,4
11.	Spatial data – Nonspatial data	2	C,D	2	1,2,4
12.	Data input - Methods	1	C,D	2	1,2,4
13.	Data Output - Methods	1	C,D	2	1,2,4
14.	Software Modules	1	C,D	2	1,2,4
15.	Vector data – Structure - Topology	1	C,D	2	1,2,4
16.	Raster data - Structure	1	C,D	2	1,2,4
17.	Raster data – Structure – Merits and Demerits	1	C,D	2	1,2,4
	UNIT III - DATA ANALYSIS	**9**			
18.	Spatial data analysis	1	C,D,I	3	1,2,4
19.	Non Spatial Data analysis	1	C,D,I	3	1,2,4
20.	Manipulation – Spatial interpolation	1	C,D,I	3	1,2,4
21.	Data retrieval – Reclassification Techniques	1	C,D,I	3	1,2,4
22.	Buffer analysis	1	C,D,I	3	1,2,4
23.	Vector and Topological Overlay analysis	1	C,D,I	3	1,2,4
24.	Raster overlay analysis	1	C,D,I	3	1,2,4
25.	Measurement - Query	1	C,D,I	3	1,2,4
26.	Record Modeling and Expert System	1	C,D,I	3	1,2,4
	UNIT IV –DIGITAL ELEVATION MODEL	**9**			
27.	Introduction – Data Capture	1	C,D,I	4	1,3
28.	Generation of DEM - Parameters	1	C,D,I	4	1,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
29.	Modeling Surface	1	C,D,I	4	1,3
30.	Applications of DEM	1	C,D,I	4	1,2,4
31.	Cost and Path analysis	1	C,D,I	4	1,2,3
32.	Digital Terrain Visualization	1	C,D,I	4	1,3
33.	TIN Generation	1	C,D,I	4	1,3
34.	DTM and DEM advantages	1	C,D,I	4	1,3
35.	DTM and DEM advantages	1	C,D,I	4	1,3
	UNIT V - APPLICATION OF GIS	**9**			
36.	Use of GIS in Resource Mapping	1	I,O	5	1,3
37.	Use of GIS in Ground Water and Runoff Modeling	1	I,O	5	1,3
38.	Use of GIS in Flood monitoring and Wetland Management	1	I,O	5	1,3
39.	Use of GIS in Forest Management	1	I,O	5	1,3
40.	Land use and Land cover analysis	1	I,O	5	1,3
41.	Use of GIS in Geology	1	I,O	5	1,3
42.	Use of GIS in Regional and Urban Planning	1	I,O	5	1,3
43.	Use of GIS in Agriculture and soil	1	I,O	5	1,3
44.	Integrated with remote sensing	1	I,O	5	1,2,3
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Anji Reddy .M, "*Remote sensing and Geographical information system*",B.S Publications, 2011.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Chestern, "*Geo Informational Systems - Application of GIS and Related Spatial Information Technologies* », ASTER Publication Co., 1992.
3.	Jeffrey Star and John Estes, "*Geographical Information System - An Introduction*", Prentice Hall, 1990.
4.	Burrough .P.A, *"Principles of GIS for Land Resources Assessment"*, Oxford Publication,1980
5.	SatheeshGopi, "*Global Positioning System - Principles and Applications,*" Tata McGraw-Hill Publishing Company Limited, New Delhi (India), 2005

Course nature				Theory			
Assessment Method (Weight age 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weight age	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weight age :			**50%**

	15CE322E	REMOTE SENSING AND ITS APPLICATIONS	L	T	P	C
			3	0	0	3

Co-requisite:	NIL	
Prerequisite:	NIL	
Data Book / Codes/Standards	NIl	
Course Category	P	DEPARTMENTAL ELECTIVE	GIS & REMOTE SENSING
Course designed by	Department of Civil Engineering	
Approval	32nd Academic Council Meeting , 2016	

PURPOSE	The purpose of this course is to provide an understanding of physical concepts and underlying various engineering and technological applications in remote sensing. In addition, the course is expected to understand the basic principles of remote sensing and its applications.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES						
At the end of the course, student will be able								
1.	To study the basic principles of remote sensing	a	c	d	e	h	k	
2.	To study the characteristics of the instrument used for remote sensing	a	c	d	e	h	k	
3.	To study and understand optical remote sensing	a	c	d	e	h	k	
4.	To understand the Basic concepts of Microwave remote sensing	a	c	d	e	h	k	
5.	To study the different areas of applications of Remote sensing	a	c	d	e	h	k	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I- - BASICS OF REMOTE SENSING	**9**			
1.	Overview of syllabus, Introduction of Remote sensing	1	C,D	1	1,2
2.	Remote Sensing in India	1	C,D	1	1,2
3.	Electromagnetic Radiation and Electromagnetic Spectrum	1	C,D	1	1,2
4.	Energy Sources & Radiation Principles	1	C,D	1	1,2
5.	Introduction to Reflection,absorption, Emission and Transmission	1	C,D	1	1,2
6.	Electromagnetic Radiation interaction with Atmosphere	1	C,D	1	1,2
7.	Electromagnetic Radiation interaction with Earth surface features	1	C,D	1	1,2
8.	Reflectance Characteristics of Earth cover types	1	C,D	1	1,3
9.	Remote Sensing Systems	1	C,D	1	1,3
	UNIT II: PLATFORMS AND SENSORS	**9**			
10.	Introduction to Platforms (Airborne, Space borne)	1	C,D	2	1,3
11.	Active Sensors and Passive Sensors	1	C,D	2	1,3
12.	Across track and along Track Scanning	1	C,D	2	1,3
13.	Optical Sensors	1	C,D	2	1,3
14.	Thermal Scanners	1	C,D	2	1,3
15.	Microwave Sensing radar	1	C,D	2	1,3
16.	LANDSAT series SPOT Series	1	C,D	2	1,3
17.	IRS Satellites	1	C,D	2	1,3
18.	Metrological Satellites , High Resolution Satellites IKONOS	1	C,D	2	1,3
	UNIT III: OPTICAL REMOTE SENSING	**9**			
19.	Classification of Remote Sensor	1	C	3	1,4
20.	Selection of sensor Parameter – Spatial Resolution, Radiometric Resolution,	1	C, D	3	1,4
21.	Selection of sensor Parameter – Spectral Resolution,	1	C,	3	1,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Temporal Resolution,		D		
22.	Optical and infrared camera	1	C, D	3	1,4
23.	Quality of image in Optical system, Imaging mode	1	C, D	3	1,4
24.	Types of Camera Photographic camera, Television Camera	1	C, D	3	1,4
25.	Introduction to Opto-Mechanical Sensors	1	C, D	3	1,4
26.	Push broom Cameras	1	C, D	3	1,4
27.	Whiskbroom Cameras	1	C, D	3	1,4
	UNIT IV: MICROWAVE REMOTE SENSING	**7**			
28.	Introduction to Microwave Remote Sensing	1	C, D	4	2,3,5,6
29.	Classification of Microwave Spectrum	1	C, D	4	2,3,5,6
30.	Airborne and Space borne radar systems	1	C, D	4	2,3,5,6
31.	System Parameters- Wave length,Polarisation,Resolutions	1	D,I	4	2,3,5,6
32.	Radar Geometry Target Parameters – Black Scattering, Point target	1	D,I	4	2,3,5,6
33.	Volume Scattering – Penetration, Reflection	1	D,I	4	2,3,5,6
34.	Application and uses of Microwave remote sensing	1	D,I	4	2,3,5,6
	UNIT V: REMOTE SENSING APPLICATIONS	**11**			
35.	Introduction to image interpretation	1	D,I	5	1,4,5,6
36.	Visual and Digital Interpretation	1	C	5	1,4,5,6
37.	Elements of image Interpretation	1	I,O	5	1,4,5,6
38.	Techniques of Image Interpretation	1	I,O	5	1,4,5,6
39.	Remote Sensing applications of Natural Resource Management	1	I,O	5	1,4,5,6
40.	Remote Sensing applications of Water with case studies	1	I,O	5	1,4,5,6
41.	Remote Sensing applications of Forest with case studies	1	I,O	5	1,4,5,6
42.	Remote Sensing applications of Agriculture and Soils with case studies	1	I,O	5	1,4,5,6
43.	Remote Sensing applications of Geology with case studies	1	I,O	5	1,4,5,6
44.	Remote Sensing applications of EIA(Air, Water and Soil Pollution with case studies	1	I,O	5	1,4,5,6
45.	Remote Sensing applications of Solid Waste management with case studies	1	I,O	5	1,4,5,6
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Floyd F. Sabins, Jr: *"Remote Sensing Principles and Interpretation"*, Freeman and Co., San Franscisco, 2007.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	*"Remote Sensing and Image Interpretation"*, 6th Edition, Thomas, Ralph W. Kiefer, Jonathan ChipmanNovember 2007, ©2008.
3.	*"Manual of Remote Sensing Vol. I*&II", 2nd Edition, American Society of Photogrammetry.
4.	Remote Sensing: *"The quantitative approach"*, P.H. Swain and S.M. Davis, McGraw

	Hill.1978.
5.	Introductory Digital Image Processing: "*A remote sensing perspective*", John R. Jensen, Prentice Hall, 2005.
6.	Imaging Radar for Resource Survey*: "Remote Sensing Applications"*, W Travelt, Chapman & Hall, 1986.

Course nature					Theory		
Assessment Method (Weight age 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle test III	Surprise Test	Quiz	**Total**
	Weight age	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weight age :			**50%**

			L	T	P	C
15CE323E	**PHOTOGRAMMETRY SURVEYING**		**3**	**0**	**0**	**3**

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIl
Course Category	P DEPARTMENTAL ELECTIVE GIS AND REMOTE SENSING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	The basic purpose of a course in Photogrammetry is to understand the basic principles and application of the many areas particularly related to civil engineering projects.

INSTRUCTIONAL OBJECTIVES			**STUDENT OUTCOMES**					
At the end of the course, student will be able								
1.	To understand the Photogrammetric techniques, concepts, components of Photogrammetry	a	b	c	e	j	k	
2.	To approximate the photographic systems and how to obtain the photographs.	a	b	c	e	j	k	
3.	To study the various platforms and photographs used in photogrammetry.	a	b	c	e	j	k	
4.	To understand how to use measurements from the photographs.	a	b	c	e	j	k	
5.	To study the application of photogrammetry in Civil Engineering.	a	b	c	e	j	k	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I- - INTRODUCTION	**9**			
1.	Overview of syllabus, Introduction of Photogrammetry	1	C	1	1,2
2.	History of Photogrammetry	1	C	1	1,2
3.	Types of Photo grammetry	1	C,D	1	1,2
4.	Photo Theodolite and its uses	1	C,D	1	1,2
5.	Ballistic Camera	1	C,D	1	1,2
6.	Different types of Aerial Photographs	1	C,D	1	1,2
7.	Oblique Terrestrial Photos	1	C,D	1	1,2
8.	Location, Camera axis and Direction	2	C,D	1	1,2
	UNIT II: PLATFORMS AND SENSORS	**9**			
9.	Introduction to Aerial Photogrammetry	1	C	2	2,3
10.	Geometric Characteristics of Aerial Photography	1	C,D	2	2,3
11.	Introduction of Scale, Types of Scale and measurements of scale	1	D,I	2	2,3
12.	FOV, IFOV GIFOV and GCP.	1	C,D	2	2,3
13.	Introduction to Flight Planning	1	C,D	2	2,3
14.	Design of Flight Planning	1	C,D	2	2,3
15.	Types of Aerial Photography	1	C,D	2	2,3
16.	End Lap and Side lap	1	C,D	2	2,3
17.	Advantages and disadvantages of Aerial Photographs	1	C,D	2	2,3
	UNIT III: - STREOSCOPY	**9**			
18.	Introduction to Stereoscopy	1	C,D	3	1,2,3
19.	Stereovision of Aerial Photographs for Three dimensional View	1	C,D,I	3	1,2,3
20.	Types of mosaic, Vertical Exaggeration	1	C,D	3	1,2,3
21.	Mirror Stereoscope and its Uses	1	C,D,I	3	1,2,3
22.	Parallax Bar and measurement of	1	C,I	3	1,2,3
23.	Relief displacement for Plain Terrain	1	C,D	3	1,2,3
24.	Relief displacement of Undulating Terrain	2	C,D	3	1,2,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
25.	Plotting Instruments	1	C,D	3	1,2,3
	UNIT IV – DIGITAL PHOTOGRAMMETRY	**9**			
26.	Introduction to digital cameras	1	C	4	1,2,3
27.	CCD and Spectral Sensitivity of CCD	1	C,D	4	1,2,3
28.	Geometric Problem of CCD	1	C,D	4	1,2,3
29.	Types of Scanner Line Scanner and Drum Scanner	1	D,I	4	1,2,3
30.	Characteristics of Scanner	1	C,D	4	1,2,3
31.	Types of Resolution	1	D,I	4	1,2,3
32.	Resolution Scanner calibration	1	C,D	4	1,2,3
33.	Introduction of Digital photogrammetric Instruments	1	C,D	4	1,2,3
34.	Orthocomp and planicomp	1	C,D	4	1,2,3
	UNIT V–PHOTOGRAMMETRY APPLICATIONS	**9**			
35.	Introduction to Planimetric Mapping	1	D,I	5	1,2,3
36.	Digital Elevation model	1	D,I	5	1,2,3
37.	Generation of DEM, Application and errors	1	D,I	5	1,2,3
38.	Digital Terrain Model and its applications	1	D,I	5	1,2,3
39.	Digital Surface Model and its applications	1	D,I	5	1,2,3
40.	Introduction to SRTM Mission and its applications	1	D,I	5	1,2,3
41.	Photogrammetric applications in town planning	1	D,I	5	1,2,3
42.	Photogrammetric applications in Disaster applications	1	D,I	5	1,2,3
43.	Photogrammetric applications in Construction of dam and canal alignment	1	D,I	5	1,2,3
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Thomas M .Lillesand, Ralph W.,"*KieferRemote Sensing & Image Interpretation",* .2009. Shiv N. Pandey, "*Principles and application of photogrammetry",*.New Age International (p) Limited, India. 2008
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Paul R. Wolf, "*Elements of photogrammetry",* McGraw Hill edition.2004.
3.	James B Campbell , "*Introduction to Remote sensing",*Taylon&francis London 2004.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

	15CE324E	ELEMENTS OF CARTOGRAPHY	L	T	P	C
			3	0	0	3

Co-requisite:	NIL		
Prerequisite:	NIL		
Data Book / Codes/Standards	NIL		
Course Category	P	DEPARTMENTAL ELECTIVE	GEOMATICS ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	To learn the fundamental concepts of Cartography and its advancements as Digital Cartography. The engineers will be enabling to different aspects of Map Making, Generalization, Map Production and Map Reproduction.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**			
At the end of the course, student will be able					
1.	To know the basics, importance, and methods of Cartography.	a	c	e	k
2.	To study the various maps projection and co-ordinate systems.	a	c	e	k
3.	To study the different aspects of design in cartography.	a	c	e	k
4.	To learn the Generalization and designing aspects of cartography.	a	c	e	k
5.	To learn the different techniques of Map production and Reproduction	a	c	e	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: INTRODUCTION TO CARTOGRAPHY	**9**			
1.	Cartography-Introduction and Civil Engineering Importance	2	C	1	1, 4, 5, 6
2.	Scope and content.	1	C	1	1, 4, 5, 6
3.	Concept of Development of Cartography	1	C	1	1, 4, 5, 6
4.	Characteristics of Map. Categories of maps	1	C	1	1, 4, 5, 6
5.	Methods of mapping, relief maps, thematic maps.	1	C	1	1, 4, 5, 6
6.	Trends in Cartography-Manual and Mechanical	1	C	1	1, 4, 5, 6
7.	Trends in Cartography-Optical, Opto-mechanical and Digital Cartography	2	C	1	1, 4, 5, 6
	UNIT II: PROJECTION AND COORDINATE SYSTEMS	**9**			
8.	Map projection, classification principles of construction of common projections,	2	C,D	2	1, 4, 5, 6
9.	Cylindrical, conical, azimuthal and globular projections,	1	C,D	2	1, 4, 5, 6
10.	Properties & Uses of projection	1	C,D	2	1, 4, 5, 6
11.	The spheroid, Map scale	1	C,D	2	1, 4, 5, 6
12.	Co-ordinate system –Cartesian, Polar and Geographical Coordinate Systems	2	C,D	2	1, 4, 5, 6
13.	UTM Coordinate system	1	C,D	2	1, 4, 5, 6
14.	Projection used in Survey of India topographic sheets	1	I,O	2	1, 4, 5, 6
	UNIT III: CATROGRAPHIC PROCESS	**9**			
15.	Processing of geographic data	1	C,D	3	3, 4, 5, 6
16.	Generalizinggeographic data	1	C,D	3	3, 4, 5, 6
17.	Measurements of Geographical data	1	C,D	3	3, 4, 5, 6
18.	Design of color and pattern,	2	C,D	3	3, 4, 5, 6
19.	Hue, Value and Chroma-Additive and Subtractive colors	1	C,D	3	3, 4, 5, 6
20.	Typography and lettering the map- Rules of	2	C,D	3	3, 4, 5, 6

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	typography				
21.	Storage formats	1	C,D	3	3, 4, 5, 6
	UNIT IV: DATA GENERALIZATION	**9**			
22.	Simplification and Classification of Cartographic Data	2	D,I	4	3, 4, 5, 6
23.	Computer assisted cartographic processes,	2	D,I	4	3, 4, 5, 6
24.	Symbolization	1	D,I	4	3, 4, 5, 6
25.	Mapping with point, line and area symbols, Volumetric Symbolization	1	D,I	4	3, 4, 5, 6
26.	Portraying the land surface form.	1	D,I	4	3, 4, 5, 6
27.	Map Compilation-Analog and Digital Compilation	2	D,I	4	3, 4, 5, 6
	UNIT V: MAP EXECUTION AND DISSEMINATION	**9**			
28.	Map production. Methods of few copies	2	D,I	5	1, 4, 5, 6
29.	Map production. Methods of many copies	1	D,I	5	1, 4, 5, 6
30.	Map reproduction: Methods of few copies and many copies	2	D,I	5	1, 4, 5, 6
31.	Formsof Art Work-Construction Methods of Art work	1	D,I	5	1, 4, 5, 6
32.	Output option- Digital cartography.	1	D,I	5	1, 4, 5, 6
33.	Geographic Information System and Applications	2	I, O	5	1, 4, 5, 6
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Cromley .R. G, "*Digital Cartography*". Prentice-Hall of India, New Delhi, 1992
2.	Dent, B. D., "*Cartography – Thematic Map Design",*. 5th Edition, W C B McGraw-Hill, Boston, 1999.
3.	Rampal .K.K, "*Mapping and Compilation*". Concept Publishing Co.,New Delhi, 1993.

	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Muller, "*Advances in Cartography",* ISBN: 1851666036, Elsevier Science Publications.
5.	Anson .R.W and Ormeling .F.J, "*Basic Cartography for students and Technicians*". Vol.., I, II and III Elsevier Applied Science publishers 2nd Edition, 1995
6.	Robinson .A. H, Morrison .J. L, Muehrcke .A. C, Kimerling .A. J. and Guptill, S. C., "*Elements of Cartography.*" 6th Edition, John Wiley and Sons, 1995.

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE325E		GPS SURVEYING	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIl
Course Category	P DEPARTMENTAL ELECTIVE GIS AND REMOTE SENSING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	This course introduces the fundamental and advanced concepts, and applications of Global Positioning System (GPS) to the undergraduate students of civil engineering

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES		
At the end of the course, student will be able				
1.	To understand the Earth's Geodetic and Reference system.	a	b	k
2.	To understand the concepts and components of GPS.	a	b	k
3.	To study the basic principles of GPS, its merits and demerits	a	b	k
4.	To understand the various errors and biases in GPS.	a	b	k
5.	To study the various application of GPS.	a	b	k

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I- - INTRODUCTIONTO GEODESY	**9**			
1.	Overview of syllabus, Fundamentals of Geodesy	1	C,D	1	1,5
2.	Shape of the Earth, Geoid, Mean Sea Level and Datum	1	C,D	1	1,5
3.	Reference Surface	1	C,D	1	1,5
4.	Introduction to Geodetic System	1	C,D	1	1,5
5.	Indian Geodetic System	1	C,D	1	1,5
6.	Elements of Coordinate System	1	C,D	1	1,5
7.	Different types of Coordinates System	2	C,D	1	1,5
8.	Projection System and classifications	1	C,D	1	1,5
	UNIT II: FUNDAMENTALS OF GLOBAL POSITIONING SYSTEM	**9**			
9.	History of Global Positioning System	1	C,D	2	1,5
10.	Elements and Components of GPS system	1	C,D	2	1,5
11.	Different Global Positioning System Programme	1	C,D	2	1,5
12.	NAVSTAR GPS	1	C,D	2	1,5
13.	Indian Regional Navigational Satellite System IRNSS	1	C,D	2	1,5
14.	Design Objectives	1	C,D	2	1,5
15.	Advantages and Disadvantages of Global Position System	1	C,D	2	1,5
16.	Limitation of Global Position System	1	C,D	2	1,5
17.	Other Navigational Systems	1	C,D	2	1,5
	UNIT III - GPS SIGNAL STRUCTURE	**9**			
18.	Introduction to GPS Signal Structure	1	C,D	3	1,4,5
19.	Various types of GPS Codes	1	C,D,I	3	1,4,5
20.	GPS Receiver : Structure of Receiver	1	C,D	3	1,4,5
21.	Types and Receiver Selection	2	C,D	3	1,4,5
22.	Principles of Position Fixing	1	C,I	3	1,4,5
23.	Pseudo Ranging	1	C,D	3	1,4,5
24.	Types of Ephemerides	1	C,D	3	1,4,5
25.	Different Data Formats	1	C,D	3	1,4,5
	UNIT IV - ERRORS AND ACCURACY	**9**			
26.	Types of Errors	1	C,D	4	1,2,5
27.	Satellite Dependent – Ephemeris errors	1	C,D	4	1,2,5
	Satellite Clock bias – Selective availability	1	C,D	4	1,2,5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
28.	Receiver Dependent – Receiver clock bias – Cycle slip	1	D,I	4	1,2,5
29.	Selective availability (SA), Observation medium dependent	1	D,I	4	1,2,5
30.	Ionospheric and Tropospheric errors	1	D,I	4	1,2,5
31.	Station dependent: Multipath – station Coordinates	1	D,I	4	1,2,5
32.	Satellite geometry based measures: Geometry dependent (Dilution of Precision:DOP)	2	D,I	4	1,2,5
	UNIT V - SURVEYING AND APPLICATIONS	**9**			
33.	GPS Field Survey Techniques	1	D,I	5	1,2,5
34.	Static Surveying and Kinematic Surveying	1	D,I	5	1,2,5
35.	Introduction to DGPS Survey	1	D,I	5	1,2,5
36.	Preparation of GPS Surveys	1	D,I	5	1,2,5
37.	Setting up on Observation Plan	1	D,I	5	1,2,5
38.	Observation Stategies and Network design	1	D,I	5	1,2,5
39.	GPS applications in Cadastral Surveys	1	D,I	5	1,2,5
40.	GPS applications in Remote sensing and GIS	1	D,I	5	1,2,5
41.	GPS applications in Military and Vehicle Tracking	1	D,I	5	1,2,5
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Akash Deep Sharma, "*Global Positioning System*", MD Publication Pvt. Ltd, New Delhi (India), 2008.
2.	Hofmann Wellenhof, B., Lichtenegger, H. and Collins, J., "*Global Positioning System: Theory and Practice*", Springer, Berlin (Germany), 1994.

	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Bradford W. Parkinson, James J. Spiker Jr., "*Global Positioning System: Theory and Applications*", Vol I and II, American Institute of Aeronautics and Astronautics: Washington (USA), 1996
4.	Gunter Seeber, "*Satellite Geodesy*", Walter de Gruyter, Berlin (Germany), 2003.
5.	AnjiReddy.M, "*Textbook of Remote Sensing and Geographical Information System*", BS Publications, Hydrabad (India), 2012.
6.	SatheeshGopi, "*Global Positioning System - Principles and Applications*," Tata McGraw-Hill Publishing Company Limited, New Delhi (India), 2005

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

ENGINEERING GEOLOGY

15CE329E	ROCK MECHANICS	L	T	P	C
		3	0	0	3
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P DEPARTMENTAL ELECTIVE GEOTECHNICAL ENGINEERING				
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	To understand the basics and application of engineering geology technology					
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**				
At the end of the course, student will be able						
1.	To understand the properties of rocks.	a	d	e	j	k
2.	To study the various types of strength of rocks.	a	d	e	j	k
3.	To study stress-strain relation of rocks.	a	d	e	j	k
4.	To understand the what is grouting, system, testing	a	d	e	j	k
5.	To study the application of rocks for engineers	a	d	e	j	k

session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I- INDEX PROPERTIES OF ROCK	**9**			
1.	Introduction	1	C D	1	1,2
2.	Physical Properties of Rocks	2	C	1	1,2
3.	Mechanical Properties of Rocks	2	C,D	1	1,2
4.	Elastic Parameters of Rocks	1	C,D	1	1,2
5.	Dynamic Property of Rocks	2	C,D	1	1,2
6.	Static and Dynamic Module	1	C,D	1	1,2
	UNIT II- ROCK STRENGTH	**9**			
7.	Types of Waves –Compressive – Measurements	1	C,D	2	1,2
8.	Theory of Wave Propagation	2	C,D	2	1,2
9.	Factors influencing Wave Velocity in Rock Mass	1	C,D	2	1,2
10.	Modest of Rock Failure	2	C,D	2	1,2
11.	Strength of Rock –	1	C,D	2	1,2
12.	Shear – Tensile – strength measurements	1	C,D	2	1,2,3
13.	Compressive – strength Measurements	1	C,D	2	1,2,3
	UNIT III - DEFORMABILITY OF ROCKS AND STRESS	**9**			

14.	Stress-Strain Behavior	2	C,D	3	1,2
15.	Initial Stress	2	C,D,I	3	1,2,4
16.	Influence of Joints	2	C,D	3	1,2,4
17.	Distribution of Stresses	2	C,D	3	1,2,4
18.	Measurements of Initial Stresses	1	C,I	3	1,2,4
	UNIT IV -ROCK GROUTING	**9**			
19.	Introduction	1	C	4	1,2,5
20.	Grouting	2	D,I	4	1,2,5
21.	Types of Grouting	2	D,I	4	1,2,5
22.	Rock Bolt -Types – Systems	2	D,I	4	1,2,5
23.	Testing of Rock Bolts	2	D,I	4	1,2,5
	UNIT V - ROCK ENGINEERING	**9**			
24.	Introduction	1	C,D,	5	1, 2, 6
25.	Application	1	C,D	5	1, 2, 6
26.	Merits and Demerits	1	C,D	5	1, 2, 6
27.	Tunneling	1	C,D	5	1, 2, 6
28.	Rock Openings	1	C,D	5	1, 2, 6
29.	Rocks for Mining Subsidence,	1	C,D	5	1, 2, 6
30.	Dam and reservoir	1	C,D,I	5	1, 2, 6
31.	Road Cuts,	1	C,D,I	5	1, 2, 6
32.	Slabs and Foundations	1	C,D,I	5	1, 2, 6
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Jaeger .C, "*Rock Mechanics for Engineers"*, Camridge University Press, 2011.
2.	Verma .B.P, "*Rock Mechanics for Engineers"*, Khanna Publication, 1997.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Goodman .P.E, "*Introduction of Rock Mechanics"*, John Wiley and Sons, 1989.
4.	Stillburg, "*Professional User Handbook for Rock Bolting"*, Tran Tech Publications, 1989.
5.	Brow .E.T, Rock Characterisation, "*Testing and Monitoring*", Pergman Press, 1981.
6.	Hock and Bray.J, "*Rock Slate Engineering"*, Institute of Mining and Metallurgy", 1981.

Course nature					Theory		
Assessment Method (Weight age 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weight age	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weight age :			**50%**

15CE331E	INDUSTRIAL POLLUTION PREVENTION AND CLEANER PRODUCTION	L	T	P	C
		3	0	0	3

Co-requisite:	NIL			
Prerequisite:	NIL			
Data Book / Codes/Standards	NIL			
Course Category	P	PROFESSIONAL ELECTIVE	ENVIRONMENTAL ENGINEERING	
Course designed by	Department of Civil Engineering			
Approval	32nd Academic Council Meeting , 2016			

PURPOSE	To develop a basic knowledge about the cleaner production and apply the same in the field application.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Know the Basics of sustainable development and about prevention against pollution	a	
2.	Know the concept of pollution prevention and cleaner production	a	
3.	Get educated on Life cycle assessment concept.	c	e
4.	Get educated on complete management principles related to the Cleaner Production and Control of Industrial Pollution.	a	c

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I-SUSTAINABLE DEVELOPMENT	**9**			
1.	Sustainable Development-Indicators of Sustainability-SustainabilityStrategies-Barriers to Sustainability-Industrial activity and Environment	3	C	1	1,2
2.	Industrialization and sustainable development-Industrial Ecology-CleanerProduction (CP) in Achieving Sustainability-Prevention versus Control ofIndustrial Pollution	3	C	1	1,2
3.	Environmental Policies and Legislations-Regulations toEncourage Pollution Prevention and Cleaner Production-Regulatory versusMarket Based Approaches	3	C	1	1,2
	UNIT II-POLLUTION PREVENTION	**9**			
4.	Definition-Importance-Historical evolution-Benefits-Promotion-Barriers-Role of Industry, Government and Institutions - Environmental ManagementHierarchy	3	C	2	1,2,3
5.	Source Reduction Techniques-Process and equipment optimization, reuse, recovery, recycle	3	C	2	1,2,3
6.	Raw material substitution-Internet Information and Other CP Resources.	3	C	2	1,2,3
	UNIT III-CONCEPT OF CLEANER PRODUCTION	**9**			
7.	Overview of CP Assessment Steps and skills, Preparing for the site visit,Information Gathering, and process flow diagram, material balance	3	C	2	1,2
8.	CP Option Generation Technical and Environmental feasibility analysis-Economic valuation of alternatives-total cost analysis	2	C	2	1,2
9.	CP Financing- Establishing a program-Organizing a program-preparing a program plan- Measuring progress	2	C	2	1,2

10.	Pollution prevention and cleaner production Awarenessplan –Waste audit-Environmental Statement	2	C	2	1,2
	UNIT IV-LIFE CYCLE ASSESSMENT	**9**			
11.	Elements of LCA-Life Cycle Costing	3	C	3	1,2
12.	Eco Labeling –Design for the Environment	3	C	3	1,2
13.	International Environmental Standards-ISO 14001-Environmental audit.	3	C	3	1,2
	UNIT V-CASE STUDIES	**9**			
14.	Industrial application of CP,LCA	3	C	4	4,5
15.	EMS	3	C	4	4,5
16.	Environmental Audits.	3	C	4	4,5
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Paul L Bishop, *"Pollution Prevention Fundamental and Practice"*,McGraw-Hill International, 2009.
2	Prasad modak, C.Visvanathan and Mandarparasnis*"Cleaner Production Audit"*, Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok, 2005.
3	S.P.Mahajan, "*Pollution Control In Process Industries",* McGraw-Hill International, 2005.
Sl.No	**REFERENCE BOOK**
4.	World Bank Group, *"Pollution Prevention and Abatement Handbook-Towards Cleaner Production"*, World Bank and UNEP, Washington D.C, 2005.
5.	Arceivala, S.J., *"Wastewater Treatment for Pollution Control",* Tata McGraw-Hill, 2008.

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

	15CE332E	GROUNDWATER CONTAMINATION AND QUALITY MONITORING AND MODELING		L	T	P	C
				3	0	0	3

Co-requisite:	NIL		
Prerequisite:	NIL		
Data Book / Codes/Standards	NIL		
Course Category	P	PROFESSIONAL ELECTIVE	ENVIRONMENTAL ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	To develop a basic knowledge about the groundwater contamination and transport modeling and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES		
At the end of the course, student will be able to			
1. Get educated on Ground water contamination and its application through models	a	c	e
2. Learn about tests for groundwater and its uses	a	c	
3. Develop knowledge on water quality models	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
1.	**UNIT I-INTRODUCTION TO GROUND WATER**	**9**			
2.	The Hydrological Cycle, Ground water Contamination and Transport, Ground Water remediation, Sources and Types of Ground water contamination Introduction	1	C	1-2	1
3.	Under Ground storage Tanks, Land fills	2	C	1-2	1
4.	Surface impoundment's, Waste disposal Injection wells Septic systems	2	C	1-2	1
5.	Agricultural wastes, land applications, Radioactive contamination, other sources of contaminates	2	C	1-2	1
6.	Data-collection methods: Introduction, Geological data acquisition	1	C	1-2	1
7.	Hydrologic data acquisition, acquisition of soil and ground water quality data.	1	C	1-2	1
	UNIT II-HYDRAULIC FLOW	**9**			
8.	Flow nets - Graphical construction - Flow nets by numerical simulation	3	C	1-2	1,2
9.	Steady state Regional Ground Water flow	2	C	1-2	1,2
10.	Steady state hydrologic budgets	2	C	1-2	1,2
11.	Fluctuations in ground water levels.	2	C	1-2	1,2
	UNIT III-DEVELOPMENT OF GROUND WATER RESOURCES	**9**			
12.	Development of Ground Water resources - Exploration for Aquifers – the response of Ideal aquifers to pumping	2	C,I	1-2	1,2
13.	Measurement of parameters -Laboratory tests - Piezometer test - Pumping tests	2	C,I	1-2	1,2
14.	Estimation of saturated hydraulic conductivity - Numerical simulation for aquifer yield prediction	2	C,I	1-2	1,2
15.	Artificial recharge and induced infiltration - Land subsidence	2	C,I	1-2	1,2
16.	Sea water intrusion.	1	C,I	1-2	1,2
	UNIT IV-CHEMICAL EQUILIBRIUM	**9**			
17.	Constituents - Chemical equilibrium -	3	C	1-2	1-4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Association and Dissociation of dissolved species - effects of concentration gradients - Mineral dissolution and solubility				
18.	Oxidation and reduction Process - Ion exchange and Adsorption - Environmental isotopes - Field Measurement of Index parameters	3	C	1-2	1-4
19.	Chemical Evolution: Hydro Chemical sequences and facies -graphical methods - Hydro chemical Facies - Ground water in carbonate terrain	3	C	1-2	1-4
	UNIT V-TRANSPORT MODELING	**9**			
20.	Water quality models – Historical development – Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations	3	C,D	1-3	1-4
21.	Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants	3	C,D	1-3	1-4
22.	Ground Water Quality Modeling - Contaminant solute transport equation, Numerical methods. Modeling Principles - MOC Modeling. Case studies	3	C,D	1-3	1-4
	Total contact hours	**45**			

	LEARNING RESOURCES
Sl. No.	**TEXT BOOKS**
1.	Randall J. Charbeneau, *"Ground water Hydraulics and Pollutant transport",* Prentice Hall, Upper Saddle River, 2009.
2.	Todd David Keith, *"Ground water Hydrology"*, Second edition, John Wiley and Sons, New York, 2010.
3.	Allen Freeze, R. and John A. Cherry, *"Ground Water"*, Prentice Hall,Inc., 2009
Sl.No	**REFERENCE**
4.	Steven C.Chapra, *Surface Water Quality Modeling*, McGraw-Hill Companies, Inc., New Delhi, 2008.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15CE333E	AIR QUALITY MONITORING AND MODELING	L	T	P	C
		3	0	0	3

Co-requisite:	Nil
Prerequisite:	Nil
Data Book / Codes/Standards	Nil
Course Category	P PROFESSIONAL ELECTIVE ENVIRONMENTAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To develop a basic knowledge about the concept of air and water quality modeling and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES		
At the end of the course, student will be able to			
1. Learn about Air pollution modeling & its application	a		c
2. Get educated on various aspects related to air pollutants	a	c	e
3. Get educated on the basic principles, development and application of air and water quality models with computer applications.	a		c

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	UNIT I - AIR QUALITY MODELING AND MONITORING	**10**			
1.	Model - definition - types - uses	2	C	1	1,2
2.	Systems and models - kinds of mathematical models - model development - ambient air quality standards	2	C	1	1,2
3.	Air monitoring - Ambient Monitoring	2	C	1	1,2
4.	Monitor types	2	C	1	1,2
	UNIT II AIR POLLUTION MODELING	**9**			
5.	Chemistry of air Pollutants - Atmospheric reactions, sinks for air pollution	2	C,I	1,2	2,4
6.	Transport of air Pollutants - Meteorological settling for dispersal of air pollutants – Vertical structure of temperature and stability	3	C,I	1,2	2,4
7.	Atmospheric motions, Wind and shear, self cleaning of atmosphere -- transport and diffusion of stack emissions	2	C,I	1,2	2,4
8.	Atmospheric characteristics significant to transport and diffusion of stack emission – stack plume characteristics.	2	C,I	1,2	2,4
	UNIT III AIR QUALITY MODELS	**9**			
9.	Types modeling technique, modeling for nonreactive pollutants, single source, short term impact	2	C,I	2,3	1,3,4
10.	Multiple sources and area sources, Fixed box models	2	C,I	2,3	1,3
11.	Diffusion models – Gaussian plume derivation	2	C,I	2,3	1,3
12.	Modifications of Gaussian plume equation- long term average-multiple cell model	2	C,I	2,3	1,3
13.	Receptor oriented and source oriented air pollution models model performance, accuracy and utilization	1	C,I	2,3	1,3
	UNIT IV - DISPERSION OF AIR POLLUTANTS	**10**			
14.	Transport and dispersion of air pollutants	2	C,I	2	1,3
15.	Wind velocity, wind speed and turbulence	2	C,I	2	1,3
16.	Estimating concentrations from point sources	2	C,I	2	1,3
17.	Gaussian Equation - atmospheric stability	8	C,I	2	1,3
18.	Air pollution modeling and prediction	1	C,I	2	1,3

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
19.	Plume rise, modeling techniques.	1	C,I	2	1,3
	UNIT V-TRANSPORT MODELING	**7**			
20.	Software package applications: Air quality modeling .	7	I	3	1,3
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	J.L.Schnoor, *Environmental Modeling Fate and Transport of Pollutants in Water, Air and Soil,* John Wiley & Sons Inc., New York, 2006.
2.	Air Pollution (Third Ed.) Volume I – *Air Pollutants, their transformation and Transport*, (Ed.) Arthur C.Stern, Academic Press, 2006.
Sl. No.	**REFERENCE BOOK**
3.	Deaton and Wine Brake, "*Dynamic Modeling of Environmental Systems*", Wiley & Sons, 2002
4.	Darrell W.Pepper and david Carrington, ¨Modeling Indoor Air Pollution", Imperial College Press, 2009

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15CE334E	ADVANCED WASTE WATER TREATMENT DESIGN	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE ENVIRONMENTAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To develop a basic knowledge about the concept of design and operation of waste water and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES	
At the end of the course, student will be able to			
1.	Learn about Basics of waste water treatment methods	a	
2.	Know about Biological processes involved in waste water treatment	a	c
3.	Get educated on principles and design of various biological treatment units used for wastewater treatment.	a	e

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	UNIT I - INTRODUCTION TO WASTEWATER TREATMENT	**9**			
1.	Introduction - Need for advanced wastewater treatment - Advanced oxidation	3	C	1	1,2
2.	Non-photochemical oxidation:selected systems and applications - photochemical oxidation	2	C	1	1,2
3.	UV photolysis –adsorption – advanced treatment applications	2	C	1	1,2
4.	Advanced wastewater technologies	2	C	1	1,2
	UNIT II DESIGN OF WASTE WATER TREATMENT UNITS	**9**			
5.	Design of sewage treatment plant units - screen chamber, Grit chamber withproportional flow weir, sedimentation tank	3	D	1	2,3
6.	Trickling filters, Rotating Biological contactor, activated sludge process & variations	2	D	1	2,3
7.	Aerated lagoons, waste stabilization ponds - reclamation and reuse	2	D	1	2,3
8.	Flow charts, layout, hydraulic profile.	2	C	1	2,3
	UNIT III - DESIGN OF BIOLOGICAL UNITS	**9**			
9.	Attached and suspended growth, Design of units	3	D	2	2,4
10.	UASB, up flow filters, Fluidized beds	3	D	2	2,4
11.	Septic tank and disposal - Layout and Hydraulic profile	2	D	2	2,4
12.	Recent advances.	1	C	2	2,4
	UNIT IV - DESIGN OF SLUDGE UNITS	**9**			
13.	Design of Sludge management facilities, sludge thickening, sludge digestion	3	D	1-2	2,4
14.	Biogas generation, sludge dewatering (mechanical and gravity)	3	D	1-2	2,4
15.	Upgrading existing plants - ultimate residue disposal - Recent Advances.	3	D	1-2	2,4
	UNIT V - PRACTICAL APPLICATIONS	**9**			
16.	Operational problems - Trouble shooting,	3	C,I	3	1-4

	Planning, Organizing and Controlling of plant operations				
17.	Capacity building - Case studies on sewagetreatment plants	3	C,I	3	1-4
18.	Sludge management facilities.	3	C,I	3	1-4
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	*"Manual on Water Supply and Treatment",* CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2009.
2.	Arceivala, S.J., *"Wastewater treatment for pollution control",* TMH,New Delhi, 2001
3.	Qasim, S.R, *"Wastewater Treatment Plant, Planning, Design & Operation",* Technomic Publications, New York, 2004.
Sl. No.	**REFERNECE BOOK**
4.	METCALF & EDDY, INC. *"Wastewater Engineering, Treatment and Reuse"*, Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2012.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE335E	DESIGN OF ENVIRONMENTAL ENGINEERING STRUCTURES	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	IS: 3370-2009
Course Category	P PROFESSIONAL ELECTIVE ENVIRONMENTAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To develop a basic knowledge about the environmental engineering structures and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES	
At the end of the course, student will be able to			
1.	Know the design principles of environmental engineering structures	c	e
2.	Learn about Treatment units and about corrosion in pipes	a	c
3.	Design environmental engineering structures such as pipes, water tanks, special structures, repair and rehabilitation of structures and maintenance.	a	

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	UNIT I – INTRODUCTION TO WASTEWATER TREATMENT	**9**			
1.	Material used for piping machines-Pre-stressed concrete, mild steel, cast iron ductile iron	3	C	1	1-4
2.	Material characteristics and comparison. Anchorage for pipes necessity-principle	3	C,D	1	1-4
3.	design force to be considered including hydro dynamic forces. Pipe laying technology.	3	C,D	1	1-4
	UNIT II-DESIGN OF ELEVATED TANKS	**9**			
4.	Capacity calculation of overhead water tanks and sumps-use of mass curve. Types of water tanks-RCC and pre-stressed concrete	3	C,D	1	1-5
5.	Strucutral efficiencies of different shapes of RCC tank- Circular- Rectangular and Intze types- Suitablity for different capacities	2	C,D	1	1-5
6.	Use of PVC tanks with conventional shapes and aesthetic ones – advantages and disadvantages	1	C	1	1-5
7.	Exposure to design codes-Use of handbooks for the design economy of different types of tanks.	3	C,D	1	1-5
	UNIT III-DESIGN OF TREATMENT UNITS	**9**			
8.	Function of underground reservoirs-intake towers	3	C,D	2	1-5
9.	settling tanks – Clari-flocculator - Aeration tanks.	3	C,D	2	1-5
10.	Functional design of intake tower- Nature of design forces-Hydraulic pressure	2	C,D	2	1-5
11.	Earth pressure-Uplift forces.	1	C,D	2	1-5
	UNIT IV-MECHANISM OF CORROSION	**9**			
12.	Mechanism of corrosion-Proneness of environmental structures to corrosion	3	C	3	1-4
13.	Precautions to be taken to prevent corrosion in planning, design, executionand maintenance stages including material selection	3	C,I	3	1-4
14.	Rehabilitation measures for distress due to corrosion.	3	C	3	1-4

	UNIT V-MAINTENANCE OF STRUCTURES	9			
15.	Importance of maintenance-Schedule of maintenance-Checklist formaintenance	3	C	2,3	1-4
16.	Manpower for maintenance	3	C	2,3	1-4
17.	Proactive maintenance- Consequence of non-maintenance.	3	C	2,3	1-4
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Ramaswamy, G.S., *"Design and Construction of Concrete shell roofs"*, CBS Publishers, India, 2006.
2.	*"Manual on Sewerage and Sewage Development"*, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2003.
3.	Krishna Raju, *"Prestressed Concrete"*, Tata McGraw Hill Publishing Co, 2nd Edition 2008.
	REFERENCE BOOK
4.	IS 3370-2009, "Code of practice Concrete structures for the storage of liquids"BIS, New Delhi, 2009.
5.	Hulse R., and Mosley, W.H., *"Reinforced Concrete Design by Computer"*, Macmillan Education Ltd., 2006.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

	15CE336E	NOISE POLLUTION CONTROL	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL l
Course Category	P PROFESSIONAL ELECTIVE ENVIRONMENTAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To learn the fundamental concepts in the field of Noise pollution and control.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES	
At the end of the course, student will be able to			
1.	Know the basics, importance of noise pollution measurement.	a	c
2.	Study the various effects of noise pollution.	a	e
3.	Learn the importance of methods of control of noise.	a	c
4.	Study the various noise pollution regulations	a	c

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I – SOURCES OF NOISE POLLUTION	**9**			
1.	Sources of noise – Units and Measurements of Noise – Noise Power level,Intensity level	3	C	1	1,2,3
2.	Pressure level – Relationship, Noise level meter – Weightednetworks – Decibel addition – Octave Band – Noise spectrum	3	C	1	1,2,3
3.	EquivalentNoise – Day and night time –Standards, Equations and Application.	3	C	1	1,2,3
	UNIT II – CHARACTERIZATION OF NOISE POLLUTION	**9**			
4.	Characterization of Noise from Construction, Mining, Transportation andIndustrial Activities	3	C	2	1,2,3
5.	Airport Noise – General Control Measures – Effects ofnoise pollution	3	C	2	1,2,3
6.	Auditory effects, non-auditory effects.	3	C	2	1,2,3
	UNIT III – PREVENTION & CONTROL OF NOISE POLLUTION	**9**			
7.	Noise Menace – Noise and the Fetus – Prevention and Control of NoisePollution –	3	C,I	3	1,2,3
8.	Control of noise at source, control of transmission, protection ofexposed person	3	C,I	3	1,2,3
9.	Control of other types of Noise Sound Absorbent – NoisePollution Analyzer	2	C,I	3	1,2,3
10.	Auditorium Designing – Anti Noise Device.	1		3	1,2,3
	UNIT IV – ACOUSTICS OF NOISE	**9**			
11.	Designing out Noise – Industrial Noise Control – effects of noise on workersefficiency	3	C,I	3	3,4
12.	Acoustic quieting – mechanical isolation technique, acousticalabsorption, constrained layer damping	3	C,I	3	3,4
13.	OSHA Noise standards – public education – other non-legislative measures	3	C,I	3	3,4
	UNIT V – REGULATORY ASPECTS OF NOISE POLLUTION	**9**			
14.	Legislation Noise and the Administrative Function – Planning against Noise– Noise and the Law – The Rajasthan noise control Act 1963	3	I	4	1,2,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
15.	Railway Act 1890 (Related to noise only), The Aircraft Act 1934 (Related to noise only)	3	I	4	1,2,3
16.	Factories Act 1948 (Related to noise only), The Environmental ProtectionAct 1986 – Noise pollution remedies.	3	I	4	1,2,3
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Peterson and E.Gross Jr., *"Hand Book of Noise Measurement"*, 7th Edn, 2003.
2.	Agarwal, *"Noise Pollution"*, APH Publishers, 2009
3.	S.P.Singal. *"Noise Pollution and Control"*, Narosa Publishing House, 2000
	REFERENCE BOOK
4.	Antony Milne, *"Noise Pollution: Impact and Counter Measures"*, David & Charles PLC, 2009

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE337E	MARINE POLLUTION MONITORING AND MODELING		L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE	ENVIRONMENTAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To develop a basic knowledge about the marine pollution monitoring and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES	
At the end of the course, student will be able to			
1.	Know about wave characteristics and living resources	a	c
2.	Learn about concept of Marine surveying and its application	a	c
3.	Get educated on aspects of marine pollution and methods of water quality assessment and marine pollution control.	a	

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	UNIT I-INTRODUCTION	**9**			
1.	General features of ocean - Conservation laws - Wave characteristics andtheories	3	C	1	1-3
2.	Sediment transport - Tides - Ocean Currents – Thermocline circulation - General circulation of ocean waters	3	C	1	1-3
3.	Tsunamis, Storm surge - Principles of Marine geology.	3	C	1	1-3
	UNIT II-LIVING RESOURCES	**9**			
4.	Living resources - coral reefs, mangroves, sea grass, seaweeds, fisherypotential	3	C	1	1-3
5.	Nonliving resources - manganese nodules, heavy minerals	3	C	1	1-3
6.	Beaches, Estuaries, Lagoons - Shoreline changes.	3	C	1	1-3
	UNIT III-MARINE SURVEYING	**9**			
7.	Sea surveying planning and preparation - Oceanographic instrumentation	3	C,I	2	1-3
8.	Hydrographic Surveying - Underwater surveying	3	C,I	2	1-3
9.	Measurement of physical properties of ocean water	2	C,I	2	1-3
10.	Sea bed sampling	1	C,I	2	1-3
	UNIT IV-SOURCES & PROPERTIES OF MARINE POLLUTION	**9**			
11.	Physiochemical properties of sea water - Sources of marine pollution and impacts on coastal ecosystems, Oil pollution	3	C,I	3	1-3
12.	Oil spill detection, dispersion, impacts on adjacent area - Oil spill modeling, mitigation measures – Oil exploration and their effects	2	C,I	3	1-3
13.	Marine outfalls - Impacts of Ports and Harbour on marine water quality - dredging - Human intervention in estuarine ecosystem - sea water classification	2	C,I	3	1-3
14.	Physical modeling in Coastal Engineering - Ocean monitoring satellites - Applications of Remote sensing and GIS in marine studies.	2	C,I	3	1-3

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	UNIT V-MODELING AND REGULATIONS	**9**			
15.	Modelling pollution dispersion, the ecosystem and water quality in coastal waters	3	C,I	1-3	1-3
16.	CASE STUDY. National and International treaties, protocols in marine pollution	3	C,I	1-3	1-3
17.	Economic Zone - Sustainable development.	3	C,I	1-3	1-3
	Total contact hours			**45**	

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Kennish, M.J., *"Pollution impacts on Marine Biotic Communities"*, CRC press New York, 2008.
2.	U.S. Army Corps of Engineers, *"Shore Protection Manual"*, Washington D.C., 2002.
Sl.No.	**REFERENCE BOOK**
3.	Newman, M.C., Roberts Jr. M.H., Male R.C. (Editors), *"Coastal and Estuarine Risk Assessment",* Lewis Publishers, Washington, D.C., 2002.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			50%

15CE338E	MASS TRANSFER IN AIR-WATER-SOIL INTERACTION		L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P PROFESSIONAL ELECTIVE	ENVIRONMENTAL ENGINEERING				
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To develop a basic knowledge about the mass transfer in air water soil interaction and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES		
At the end of the course, student will be able to			
1. Learn about Basics of heat and mass transfer	a		
2. Get educated on the concept of liquid and gases	a		
3. Get educated on the mechanism of material transfer betweenenvironmental components - air, water and soil.	a	c	e

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	UNIT I-INTRODUCTION	**9**			
1.	Ideal solutions - air - water equilibrium occurrences - pure gases in contactwith water-pure liquid in contact with air - partition coefficient for the air - water system	3	C	1	1-2
2.	Earthen solid - waste equilibrium occurrences - pure solid andliquid chemicals in contact with water and earthen solids	3	C	1	1-2
3.	Earthen solid – air equilibrium occurrences - water - liquid chemical equilibrium occurrences - thermal equilibrium at environmental interfaces.	3	C	1	1-2
	UNIT II-HEAT & MASS TRANSFER	**9**			
4.	Diffusion and mass transfer - molecular diffusion - eddy diffusion – masstransfer theories - mass transfer coefficients - binary mass transfer	3	C	1	1-2
5.	Coefficients in two phases and two resistance theory of interphase masstransfer turbulence in the environment	3	C	1	1-2
6.	Fundamentals of heat transfer - analogy theories of momentum, heat and mass transfer	3	C	1	1-2
	UNIT III-CONCEPT OF LIQUID & GASES	**9**			
7.	Desertion of gases and liquids from aerated basins and rivers – completelymixed basin	3	C	2	1-2
8.	Plug flow basin - gas exchange rates between the atmosphereand the surface of rivers	3	C	2	1-2
9.	Exchange of chemical across the air – waterinterface of lakes and oceans	3	C	2	1-2
	UNIT IV-DISSOLUTION OF CHEMICALS	**9**			
10.	Dissolution of chemicals on the bottom of flowing streams - geometric forms- stream bottom mass transfer coefficients - natural convection dissolution	3	C	2	1-2
11.	The upsurge of chemicals from the sediment - water interface of lakes – aFikian analysis - annual upsurge rate at sediment - water interface –	3	C	2	1-2

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	masstransfer coefficients at the sediment				
12.	Water interface – mass transfer coefficients at the sediment - water interface. Flux of chemicals between sediment and the overlying seawater - movement of chemicals through the benthic boundary layer.	3	C	2	1-2
	UNIT V-AIR & SOIL INTERFACE	**9**			
13.	Turbulence above the air - soil interface - the Richardson number – chemicalflux rates through the lower layer of the atmosphere	3	C	3	1-2
14.	Thronthwaite -Holzman equation - evaporation of liquid chemicals spilled on land	3	C	3	1-2
15.	Chemical flux rates through the upper layer of earthen material.	3	C	3	1-2
	Total contact hours		**45**		

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Thibodeaux, L.J, *"Environmental Chemo dynamics: Movement Of Chemicals In Air, Water and Soil",* edition 2., Wiley – Inter science, New York, 2006.
Sl. No.	**REFERENCE BOOK**
2.	Cusssler, E.L, *"Diffusion: Mass Transfer In Fluid Systems",*Cambridge University press, 2004.

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE339E		INSTRUMENTAL MONITORING OF ENVIRONMENT AND MODELING		L	T	P	C
				3	0	0	3
Co-requisite:	NIL						
Prerequisite:	NIL						
Data Book / Codes/Standards	NIL						
Course Category	P	PROFESSIONAL ELECTIVE	ENVIRONMENTALENGINEERING				
Course designed by	Department of Civil Engineering						
Approval	32nd Academic Council Meeting , 2016						

PURPOSE	To develop a basic knowledge about the instrumental monitoring of environment and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES	
At the end of the course, student will be able to			
1.	Know the basics, importance of Soil Pollution	a	e
2.	Get educated on the various instruments used for analysis ofair water and soil.	a	c

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I-INTRODUCTION	**9**			
1.	Instrumental Methods, Selection of method,	3	C	1	1
2.	Precision and Accuracy, Erosion measuring signals,	3	C	1	1
3.	Noise/ signal ratio, base line drift, Indicator tubes.	3	C	1	1
	UNIT II-INSTRUMENTAL METHODS	**9**			
4.	Electromagnetic radiation, matter radiation interactions; Colorimetry and spectrophotometry, fluorimetry, nephelometry and turbidimetry,	3	C	1,2	2
5.	Flame photometry Atomic Absorption Spectrophotometry (AAS), Atomic Emission Spectrophotometry (AES)	3	C	1,2	2
6.	Inductively coupled plasma (ICP) and Direct Current Plasma (DCP) spectrometry. ICP - MS (Mass spectrometry).	3	C	1,2	2
	UNIT III-CLASSICAL METHODS	**9**			
7.	Classical methods, Column, Paper and thin layer chromatography (TLC)	3	C	2	1,2
8.	Gas Chromatography (GC), GC-MS,	3	C	2	1,2
9.	High performance liquid chromatography (HPLC) and Ion chromatography (IC).	2	C	2	1,2
10.	Introduction to Scanning Electron Microscope- type- uses and advantages	1			
	UNIT IV-METHODS BASED ON RAYS	**9**			
11.	Conductometry, potentiometry, coulometry, amperometry	3	C	2	1,2
12.	Paleography, Neutron Activation Analysis (NAA),	3	C	2	1,2
13.	X-ray Fluorescence (XRF) and X-ray Diffraction (XRD) methods.	3	C	2	1,2
	UNIT V-MISCELLANEOUS METHODS	**9**			
14.	Non - dispersive infra-red (NDIR) analyzer for CO	3	C	1,2	1,2
15.	Chemiluminescent analyzer for NOx, Fluorescent analyzer for SO2,	3	C	1,2	1,2
16.	Auto analyzer for water quality using flow injection analysis; permeation devices.	3	C	1,2	1,2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Willard. H., Merritt, L., Dean, D.A. and Settle. F.A. *"Instrumental methods of analysis"*, 7th Edn. Words Worth, New York, 2004.
	REFERENCE BOOKS
2.	Ewing, *"Instrumental Methods of Chemical Analysis"*, 5th Edn.,Mc Graw-Hill, New York, 2005.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE340E	RS AND GIS FOR ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P	PROFESSIONAL ELECTIVE	ENVIRONMENTAL ENGINEERING		
Course designed by	Department of Civil Engineering				
Approval	32nd Academic Council Meeting , 2016				

PURPOSE	To develop a basic knowledge about the Remote Sensing and GIS forenvironmental engineering and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES	
At the end of the course, student will be able to		
1. Know the basics of environment such as water, air and land	a	
2. Learn about concept of geology	a	c
3. Study the RS And GIS application for Environmental Engineering.	a	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I-ENVIRONMENT	**9**			
1.	Water - Air-Land	3	C	1	1-3
2.	Marine Environment Global Climatologic	3	C	1	1-3
3.	Urban Environment:	3	C	1	1-3
	UNIT II-INTRODUCTION TO REMOTE SENSING	**9**			
4.	Role of RS in different types of Environments - Air, Water	3	C	1	1-3
5.	Land.GIS for marine environment	3	C	1	1-3
6.	urban environment	3	C	1	1-3
	UNIT III-CONCEPT OF GEOLOGY	**9**			
7.	Introduction - spectral characteristics of water	3	C	2	1-3
8.	Soil, rock-water parameter	3	C	2	1-3
9.	Pollution studies.	3	C	2	1-3
	UNIT IV-INTRODUCTION TO GIS	**9**			
10.	GIS-introduction-role of GIS - data analysis	3	C	1,2	1-3
11.	Thematic maps preparation	3	C	1,2	1-3
12.	Modeling.	3	C	1,2	1-3
	UNIT V-APPLICATION OF GIS	**9**			
13.	GIS for - soil erosion-Land degradation-	3	I	3	1-3
14.	Ecology-degradation-Coastal marine studies	3	I	3	1-3
15.	Water Quality, monitoring and management.	3	I	3	1-3
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Lilliesand, T.M. and Kiefer, R, W., *"Remote Sensing and Image Interpretation"*, John Wily and sons, 2004.
2.	Burrough, P.A. and, McDonnell, R.A., *"Principles of Geograj1JhicaJ Information Systems"*, Oxford University Press, 2009.
Sl.No	**REFERENCE BOOK**
3.	Lintz, J. and Simonet, *"Remote Sensing of Environment",* AddisonWesley Publishing Company, 2004.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

	15CE341E	AIR POLLUTION CONTROL AND MANAGEMENT	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE ENVIRONMENTAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To develop a basic knowledge about the Air Pollution and its control and management	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	Know the basics of air pollutants and its measurement	a
2.	Get educated on control methods on air pollution	a e
3.	Learn various methods of control of particulate and gaseous air pollutants.	a

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I-SOURCES AND CLASSIFICATION OF AIR POLLUTANTS	**9**			
1.	Sources and classification of Air Pollutants: Natural air pollutants-aerosolgases and vapour	2	C	1	1-3
2.	Meteorology and Air pollution: Atmospheric stability and inversions-mixing height-plume behaviour-plume rise estimation	2	C	1	1-3
3.	Impact of air pollutants on human/structure/vegetation/global warming	2			
4.	Effluent dispersion theories-Isokinetic sampling-Modeling.	3	C	1	1-3
	UNIT II-AIR QUALITY MEASURES	**9**			
5.	Objectives-Filters, gravitational, centrifugal-multiple type cyclones, prediction of collection efficiency	3	C	1	1-3
6.	Pressure drop, wet collectors, Electrostatic Precipitation theory	2	C	1	1-3
7.	Particle charging collection-ESP design procedure.	2	C,D	1	1-3
8.	Ambient air quality monitoring – respirable dust sampler and fine dust sampler	2	C,D	1	1-3
	UNIT III-THEORY OF ADSORPTION	**9**			
9.	Absorption: principles,impingements-description of equipment-packed and plate columns, design and performance equations	3	C	1,2	1-3
10.	Adsorption: principles adsorbents, equipment descriptions-PSA-adsorption cycle-solvent recovery system	2	C	1,2	1-3
11.	Continuous rotary bed-fluidized bed, Design and performance equations. Condensation: contact condensers-shell and tube condensers, design and performance equation	2	C	1,2	1-3
12.	Incineration: hydrocarbon incineration kinetics, equipment description, design and performance equations.	2	C	1,2	1-3
	UNIT IV-CONTROL METHODS	**9**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
13.	Control methods-Processes based control mechanisms-mineral products asphaltic concrete, cement plants and glass manufacturing plants	3	C	2	1-3
14.	Thermal power plants, Petroleum refining and storage plants, Fertilizers	3	C	2	1-3
15.	Pharmaceuticals and wood processing industry. Field study	3	C	2	1-3
	UNIT V-AIR QUALITY STANDARDS	**9**			
16.	Air quality and emission standards	3	C	3	1-3
17.	Air pollution indices, and air qulity monitoring in chimnies using stack monitoring kit	3	C	3	1-3
18.	Disaster management in case of failure of control equipment	3	C	3	1-3
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No	**TEXT BOOKS**
1.	Richard W.Boubel et al, *"Fundamentals of Air Pollution",* Academic Press, New York, 2004.
2.	M.N. Rao et al, *"Air Pollution",* Tata McGraw Hill, 2009
Sl. No	**REFERENCE BOOK**
3.	Noel de Nevers, *"Air Pollution control Engg."* McGraw-Hill, New York, 2005

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE342E	ENVIRONMENTAL HEALTH ENGINEERING	L	T	P	C
		3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P PROFESSIONAL ELECTIVE ENVIRONMENTAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32ndAcademic Council Meeting , 2016

PURPOSE	To develop a basic knowledge about the environmental health and safety in work place

INSTRUCTIONAL OBJECTIVES		STUDENT OUTCOMES	
At the end of the course, student will be able to			
1.	Develop a knowledge on environmental safety and hygiene.	a	c
2.	Get educated on workplace safety	a	c
3.	Get training on Environmental Health engineering	a	

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	UNIT – I Introduction	**9**			
1.	Need for developing Environment, Health and Safety systems in work places.	3	C	1	1-3
2.	Status and relationship of Acts, Regulations and Codes of Practice. Role of trade union safety representatives.	3	C	1	1-3
3.	International initiatives. Ergonomics and work place.	3	C	1	1-3
	UNIT II- Occupational Health and Hygiene	**9**			
4.	Definition of the term occupational health and hygiene. Categories of health hazards. Exposure pathways and human responses to hazardous and toxic substances	3	C,I	1	1-3
5.	Advantages and limitations of environmental monitoring and occupational exposure limits. Hierarchy of control measures for occupational health risks. Role of personal protective equipment and the selection criteria	3	C,I	1	1-3
6.	Effects on humans, control methods and reduction strategies for noise, radiation and excessive stress.	3	C,I	1	1-3
	UNIT III- Workplace Safety	**9**			
7.	Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision	3	C,I	2	1-3
8.	Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations	2	C,I	2	1-3
9.	Control methods to eliminate or reduce the risks arising from the use of work equipment. Requirements for the safe use of display screen equipment.	2	C,I	2	1-3
10.	Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.	2	C,I	2	1-3
	UNIT IV - Techniques of Environmental Safety	**9**			
11.	Elements of a health and safety policy and	3	C,I	3	1-3

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	methods of its effective implementation and review. Functions and techniques of risk assessment, inspections and audits.				
12.	Investigation of accidents Principles of quality management systems in health and safety management	3	C,I	3	1-3
13.	Relationship between quality manuals, safety policies and written risk assessments. Records and other documentation required by an organization for health and safety. Industry specific EHS issues.	**3**	C,I	3	1-3
	UNIT V- Education and Training	**9**			
14.	Requirements for and benefits of the provision of information, instruction, training and supervision	3	I	1,3	1-3
15.	Factors to be considered in the development of effective training programmes	3	I	1,3	1-3
16.	Principles and methods of effective training. Feedback and evaluation mechanism.	3	I	1,3	1-3
	Total contact hours	**45**			

	LEARNING RESOURCES
Sl. No.	**TEXT BOOKS**
1.	Brian Gallant, *"Facility Manager's Guide to Environmental Health and Safety",* by Government Inst Publ., 2007.
2.	Bill Taylor,*"Effective Environmental, Health, and Safety Management Using the Team Approach",* by Culinary and Hospitality Industry Publications Services 2005.
Sl.No	**REFERENCE BOOK**
3.	Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew,*"Environmental and Health and Safety Management",* by Inc. New York, 1995.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE343E		**ENVIRONMENTAL IMPACT ASSESSMENT**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Co-requisite:	NIL		
Prerequisite:	NIL		
Data Book / Codes/Standards	NIL		
Course Category	P	PROFESSIONAL ELECTIVE	ENVIRONMENTAL ENGINEERING
Course designed by	Department of Civil Engineering		
Approval	32nd Academic Council Meeting , 2016		

PURPOSE	To develop a basic knowledge about the environmental impact assessment and apply the same in the field application.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Know the basics of environmental impact assessment	a	
2.	Learn about evaluation for EIA	a	e
3.	Get educated the students on the scope, steps involved and various methods related to assessment of environmental impact due to development projects.	a	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOS**	**Reference**
	UNIT I-INTRODUCTIONTOEIA	**9**			
1.	Environmental Impact Assessment (EIA) - Environmental Impact Statement -Environmental Risk assessment	3	C	1	1,3
2.	Legal and Regulatory aspects in India - Types and limitations of EIA	3	C	1	1,3
3.	Terms of reference in EIA - Issues in EIA - National - Cross sectoral - social and cultural	3	C	1	1,3
	UNIT II-ASSESSMENT TECHNIQUES IN EIA	**9**			
4.	Components - screening - setting - analysis - Prediction of impacts -mitigation.	3	C	1	1,3
5.	Matrices - Networks - Checklists - Importance assessment techniques	3	C	1	1,3
6.	Cost benefit analysis - Analysis of alternatives - methods for prediction and assessment of impacts - air - water - soil - noise	2	C	1	1,3
7.	Biological -cultural - social - economic environments.	2	C	1	1,3
	UNIT III-EVALUATION OF EIA	**9**			
8.	Standards and guidelines for evaluation Public participation in environmental decision making trends in EIA practice and evaluation criteria	3	C	2	1,3
9.	Capacity building for quality assurance. Expert system in EIA	3	C	2	1,3
10.	Use of regulations and AQM.	3	C	2	1,3
	UNIT IV-EVALUATION OF EIA	**9**			
11.	Document planning - collection and organization of relevant information -use of visual display materials team writing	3	C	2,3	1-3
12.	Reminder checklist .Environmental monitoring - guidelines - policies - planning of monitoring programmes.	3	C	2,3	1-3
13.	Environmental management plan. Post project audit.	3	C	2,3	1-3

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	UNIT V-CASE STUDIES OF EIA	**9**			
14.	Case studies of EIA of developmental projects	9	I	3	4
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No	**TEXT BOOKS**
1.	Petts, J., *"Handbook of Environmental Impact Assessment",* Vol., I and II, Conwell Science London. 2009.
2.	Canter, L.W., *"Environmental Impact Assessment"*, McGraw-Hill,New York. 2006
3.	Biswas, A.K. and Agarwala, S.B.C., *"Environmental Impact Assessment for Developing Countries"*, Butterworth Heinemann,London. 2004
Sl.No	**REFERENCE BOOK**
4.	Lawrence, D.P., *"Environmental Impact Assessment – Practical solutions to recurrent problems",* Wiley-Interscience, New Jersey2003.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
				End semester examination Weightage :			**50%**

15CE344E		INDUSTRIAL WASTE MANAGEMENT	L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE	ENVIRONMENTAL ENGINEERING			
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To develop a basic knowledge about the concept of industrial wastewater management and apply the same in the field application.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Know the concept and reasons for industrial pollution	a	
2.	Learn about treatment methods and disposal of effluent.	a	e
3.	Get Educated on complete management principles related to individual wastewater starting from wastewater source identification up to reuse concepts.	a	

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	UNIT I-INTRODUCTION	**9**			
1.	Industrial scenario in India- Industrial and Environment-Uses of water by industry-Sources and types of industrial wastewater	3	C	1	1-5
2.	Industrial wastewater and environmental impacts-regulatory requirements for treatment of industrial wastewater-Industrial waste survey-Industrial Wastewater generation rates.	3	C	1	1-5
3.	Characterization and variables-Population equivalent-Toxicity of Industrial effluents and Bioassay tests.	3	C	1	1-5
	UNIT-II INDUSTRIAL POLLUTION PREVENTION	**9**			
4.	Prevention Vs control of Industrial Pollution-Benefits and Barriers-Source reduction techniques Waste audit	3	C	1	1-5
5.	Evaluation of Pollution Prevention options-Environmental statement as a tool for Pollution	3	C	1	1-5
6.	Prevention-Waste minimization Circles.	3	C	1	1-5
	UNIT-III INDUSTRIAL WASTEWATER TREATMENT	**9**			
7.	Equalization- Neutralization- Oil separation-Flotation-Precipitation-Heavy metal Removal -Refractory organics separation by adsorption.	3	C	12	1-5
8.	Aerobic and anaerobic biological treatment Sequencing batch reactors-High Rate reactors-Chemical Oxidation –Ozonation.	3	C	1,2	1-5
9.	Photo catalysis Wet Air Oxidation-Evaporation-Ion Exchange-Membrane Technologies - Nutrient removal.	3	C	1,2	1-5
	UNIT-IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT	**9**			
10.	Individual and Common Effluent Treatment Plants-Joint treatment of industrial Wastewater-	3	C	2	1-5

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
	Zero effluent discharge Systems-Quality requirements for Wastewater reuse.				
11.	Industrial reuse-Disposal on Water and land-Residuals of industrial Wastewater treatment-Quantification and Characteristics of Sludge-	3	C	2	1-5
12.	Thickening, digestion, conditioning, dewatering and disposal of sludge-Management of RO rejects.	**3**	C	2	1-5
	UNIT-V CASE STUDIES	**9**			
13.	Industrial manufacturing Process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles.	3	I	3	1-5
14.	Tanneries-pulp and paper-metal finishing Petroleum Refining-Pharmaceuticals-Sugar and Distilleries	3	I	3	1-5
15.	Food Processing-fertilizers-Thermal Power Plants and Industrial Estates.	3	I	3	1-5
	Total contact hours	**45**			

LEARNING RESOURCES

Sl. No.	TEXT BOOKS
1.	Eckenfelder,W.W., "*Industrial Water Pollution Control",* McGraw-Hill, 1999
2.	Arceivala, S.J., "*Wastewater Treatment for Pollution Control*", Tata McGraw-Hill. 1998.
3.	Frank Woodard.," *Industrial Waste treatment Handbook"*, Butterworth Heinemann,New Delhi, 2001.

Sl.No	REFERENCE BOOK
4.	World Bank Group, "*Pollution Prevention and Abatement Handbook-Towards Cleaner Production",* World Bank and UNEP, Washington D.C.1998.
5.	Paul L.Bishop "*Pollution Prevention;- Fundamentals and practice*", McGraw-Hill International, 2000

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

	15CE345E	**MUNICIPAL SOLID WASTE MANAGEMENT**	L	T	P	C
			3	0	0	3

Co-requisite:	NIL
Prerequisite:	NIL
Data Book / Codes/Standards	NIL
Course Category	P	PROFESSIONAL ELECTIVE	ENVIRONMENTAL ENGINEERING
Course designed by	Department of Civil Engineering
Approval	32nd Academic Council Meeting , 2016

PURPOSE	To learn the collection, storage, transport, treatment, disposal and recycling options for solid waste.

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES	
At the end of the course, student will be able to		
1. Know the sources, types and characterization of solid waste.	c	
2. Learn the importance of methods of collection, storage and transport of solid waste.	c	e
3. Understand the various treatment methods and disposal of solid waste	c	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: SOURCES AND TYPES OF MUNICIPAL SOLID WASTES	9			
1.	Introduction -Sources and types of solid wastes	2	C	1	1-5
2.	quantity – factors affecting generation of solid wastes	2	C	1	1-5
3.	Need for solid waste management – public health effects	2	C	1	1,3,4
4.	Salient features of Indian Legislations on management and handling of municipal solid wastes	2	C	1	1,3,4,5
5.	Elements of Integrated waste management - public awareness.	1	C,I	1	1,3,4,5
	UNIT II: WASTE CHARACTERIZATION AND SOURCE REDUCTION	9			
6.	Waste generation rates and variation-composition	2	C	1	1,3,4,5
7.	Physical, chemical and biological properties of solid waste	3	C	1	1,3
8.	Waste sampling and characterization plan	2	C	1	1,3
9.	Source reduction of wastes-recycling and reuse	2	C,I	1	3,4
	UNIT III –STORAGE,COLLECTION AND TRANSPORT OF WASTES	9			
10.	Handling and segregation of wastes at source	2	C	2	1
11.	Storage and collection of municipal solid wastes	2	C,I	2	1,4,5
12.	Analysis of collection systems –HCS-SCS systems types of vehicles	2	C,D	2	4,5
13.	Need for transfer and transport - transfer stations	2	C	2	1,2
14.	Preparation of master schedule- collection routes-manpower requirement	1	C	1,2	1,2
	UNIT IV - WASTE PROCESSING TECHNOLOGIES	9			
15.	Objectives of waste Processing- Processing techniques and Equipment	2	C	3	4
16.	Biological conversion technology – energy recovery - Incineration	3	C	3	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
17.	Composting- methods and controls of composting	2	C	3	4,5,6
18.	Resource recovery from solid wastes	2	C	3	4,5,6
	UINT V – DISPOSAL OF SOLID WASTE	**9**			
19.	Dumping of solid waste- sanitary landfills- waste disposal options	3	C	3	1,3,4
20.	site selection- design and operation of sanitary landfills	3	D,C	3	5,6
21.	Leachate collection & treatment-landfill remediation	3	C	3	3,4,6
	Total contact hours		**45**		

	LEARNING RESOURCES
Sl.No	**TEXT BOOKS**
1.	George Tchobanoglouset.al., "*Integrated Solid Waste Management*", McGraw-Hill Publishers, 2003.
2.	Al. Ramanathan, and Jagbir Singh, "*Solid Waste Management*", S.K.Kataria & Sons, New Delhi, 2010
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Bilitewski .B, HardHe .G, Marek .K, Weissbach.A, and Boeddicker .H, "*Waste Management*", Springer, 2004.
4.	Manual on Municipal Solid Waste Management, *"CPHEEO",* Ministry of Urban Development, Government of India, New Delhi, 2010.
5.	Landreth .R.E and Rebers .P.A, *"Municipal Solid Wastes – problems and Solutions",* Lewis Publishers, 2002.
6.	Bhide .A.D. and Sundaresan .B.B, *"Solid Waste Management in Developing Countries*", INSDOC, 2003.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**