NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi) Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabi
for
BE - Civil Engineering [R17]
[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year 2017-2018 onwards)

SEPTEMBER 2021

Civil Engineering Department PEOs and POs

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 To exhibit good depth of knowledge in core areas of Civil and allied Engineering.

PEO2 To communicate profound knowledge in fundamentals, techniques and design of Civil Engineering system that encourages them to develop innovative techniques in their professional practice.

PEO3 To develop an understanding of the multidisciplinary approach and an ability to relate Engineering issues to broader social and human context in which their Engineering contributions will be utilized.

PEO4 To Engage in life-long continuous learning through independent study and participation in professional conferences, seminars and workshops.

PROGRAMME OUTCOMES (POs)

At the end of a programme a students will be able to demonstrate ability to

a-l	GRADUATE ATTRIBUTEs	PO No.	PROGRAMME OUTCOMEs
A	Engineering Knowledge	PO1	An ability to apply knowledge of computing, fundamental mathematics, algorithmic principles and Civil Engineering theory in design to solve the real-world problems systems
B	Problem Analysis	PO2	An ability to identify the basic principles, mathematical tools and apply the fundamentals in the field of engineering sciences.
C	Design and Development of Solutions	PO3	An ability to make the graduates, who come with a background of social science and humanities, realize the impact of engineering solutions on the quality of life and physical environment in a global and societal context.
D	Investigation of Complex Problems	PO4	An ability to make graduates be aware of the continued research in the field of civil engineering and will actively engages themselves in research and development.
E	Modern Tool Usage	PO5	An ability to be aware of the emerging technologies, equip themselves with current techniques, tools and utilize the same to solve issues in the professional field.
F	The Engineer and Society	PO6	An ability to understand the duties as professional engineers in the society, protect the public health, safety and welfare, act against plagiarism and respect the copyrights and patents of others.
G	Environment and Sustainability	PO7	An ability to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
H	Ethics	PO8	An ability to apply the basic ethical principles with commitments in civil engineering field
I	Individual and Team Work.	PO9	An ability to realize the importance of teamwork and work with in multi-disciplinary team.
J	Communication	PO10	An ability to communicate effectively on civil engineering activities with engineering society to produce reports through written, oral and graphical methods
K	Project Management and Finance	PO11	An ability to recognize the role of a leader, leadership principles to manage projects in multidisciplinary environments
L	Lifelong Learning	PO12	An ability to engage in continual professional development and life-long learning

PROGRAMME SPECIFIC OBJECTIVES:

PSO1: To recognize the importance of Civil Engineering professional development by pursuing postgraduate studies.

PSO2: To face competitive examinations that offer challenging and rewarding careers.

PSO3: Ability to apply design, develop and execution of projects in the construction of various civil engineering disciplines.

PSO4: Ability to become a good entrepreneur and to improve the management skills.

Contribution **1: Reasonable** **2: Significant** **3: Strong**

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	a	b	c	d	e	f	g	h	i	j	k	l
1	3	2	3	3	3	2	2	3	2	3	2	3
2	2	3	2	3	3	2	2	2	1	1	2	3
3	3	1	1	3	3	2	3	2	1	2	1	2
4	2	1	2	3	2	2	2	2	3	2	2	2
5	3	2	2	2	2	1	1	2	1	1	2	3

MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

PROGRAM SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	a	b	c	d	e	f	g	h	i	j	k	l
1	3	2	2	3	1	1	1	2	1	1	2	3
2	3	3	2	2	3	1	2	1	2	1	1	2
3	3	3	2	3	3	3	2	3	2	2	1	3
4	3	3	3	2	3	2	2	3	2	3	2	3

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – 2017 **CHOICE BASED CREDIT SYSTEM**

B.E. CIVIL ENGINEERING

CURRICULUM & SYLLABUS: I - VIII SEMESTERS

SEMESTER: I									
SL.NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17EYA01	Professional English - I	HS	NIL	4	2	0	2	3
2.	17MYB01	Calculus and Solid Geometry	BS	NIL	5	3	2	0	4
3.	17PYB01	Physics for Engineers	BS	NIL	3	3	0	0	3
4.	17CYB01	Applied Chemistry	BS	NIL	3	3	0	0	3
5.	17MEC01	Engineering Graphics	ES	NIL	4	2	2	0	3
6.	17CEC01	Fundamentals of Engineering Mechanics	ES	NIL	5	3	2	0	4
PRACTICALS									
7.	17GYP01	Physics and Chemistry Laboratory	BS	NIL	4	0	0	4	2
8.	17GYP02	Engineering Practices Laboratory	ES	NIL	4	0	0	4	2
9.	17GEP01	Personal Values	HS	NIL	2	0	0	2	0
				TOTAL	**34**	**16**	**6**	**12**	**24**

SEMESTER: II									
SL. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17EYA02	Professional English – II	HS	17EYA01	4	2	0	2	3
2.	17MYB02	Complex Analysis and Laplace Transforms	BS	17MYB01	5	3	2	0	4
3.	17PYB03	Materials Physics	BS	17PYB01	3	3	0	0	3
4.	17CYB03	Environmental Science	BS	NIL	3	3	0	0	3
5.	17EEC01	Basic Electrical and Electronics Engineering	ES	NIL	3	3	0	0	3
6.	17CSC01	Problem Solving and Python Programming	ES	NIL	3	3	0	0	3
PRACTICALS									
7.	17CSP01	Problem Solving and Python Programming Laboratory	ES	NIL	4	0	0	4	2
8.	17CEP01	Building Drawing – I	ES	NIL	4	0	0	4	2
9.	17GEP02	Inter Personal Values	HS	17GEP01	2	0	0	2	0
				TOTAL	**31**	**17**	**2**	**12**	**23**

SEMESTER: III									
SL. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17MYB03	Fourier Series and Partial Differential Equations	BS	NIL	4	2	2	0	3
2.	17CEC02	Engineering Geology	PC	NIL	3	3	0	0	3
3.	17CEC03	Mechanics of Solids – I	ES	17CEC01	5	3	2	0	4
4.	17CEC04	Mechanics of Fluids	PC	NIL	3	3	0	0	3
5.	17CEC05	Building Materials#	PC	NIL	5	3	0	2	4
6.	17CEC06	Surveying	PC	NIL	3	3	0	0	3
PRACTICALS									
7.	17CEP02	Surveying Laboratory	PC	NIL	4	0	0	4	2
8.	17GED01	Soft Skills-Listening and Speaking	EEC	NIL	2	0	0	2	0
				TOTAL	**29**	**17**	**4**	**8**	**22**

SEMESTER: IV									
SL. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17MYB07	Numerical Methods	BS	NIL	4	2	2	0	3
2.	17CEC07	Mechanics of Solids – II	ES	17CEC03	5	3	2	0	4
3.	17CEC08	Soil Mechanics#	PC	17CEC02	5	3	0	2	4
4.	17CEC09	Highway Engineering	PC	NIL	3	3	0	0	3
5.	17CEC10	Applied Hydraulics Engineering	PC	17CEC04	3	3	0	0	3
6.	17CEC11	Concrete Technology	PC	17CEC05	3	3	0	0	3
PRACTICALS									
7.	17CEP03	Building Drawing –II	ES	17CEP01	4	0	0	4	2
8.	17CEP04	Hydraulics Engineering Laboratory	PC	17CEC04	4	0	0	4	2
9.	17GED02	Soft Skills- Reading and Writing	EEC	NIL	2	0	0	2	0
10.	17GED03	Personality and Character Development	EEC	NIL	2	0	0	1	0
				TOTAL	**35**	**17**	**4**	**13**	**24**

SEMESTER: V									
SL. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17CEC12	Structural Analysis – I	PC	17CEC07	5	3	2	0	4
2.	17CEC13	Design of Reinforced Concrete Elements	PC	NIL	5	3	2	0	4
3.	17CEC14	Foundation Engineering	PC	17CEC08	3	3	0	0	3
4.	17CEC15	Water Resources and Irrigation Engineering	PC	NIL	3	3	0	0	3
5.	E1	Elective - I (PSE)	PSE	--	3	3	0	0	3
6.	E2	Elective - II (PSE)	PSE	--	3	3	0	0	3
PRACTICALS									
7.	17CEP05	Concrete and Highway Engineering Laboratory	PC	17CEC11	4	0	0	4	2
8.	17CEP06	Employability Skills – I	EEC	NIL	2	0	0	2	0
9.	17GED07	Constitution of India	EEC	NIL	2	2	0	0	0
				TOTAL	**30**	**20**	**4**	**6**	**22**

SEMESTER: VI									
SL. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17CEC16	Structural Analysis – II	PC	17CEC12	5	3	2	0	4
2.	17CEC17	Design of Steel Structures	PC	17CEC03	5	3	2	0	4
3.	17CEC18	Design of Reinforced Concrete Structures	PC	17CEC13	3	3	0	0	3
4.	17CEC19	Environmental Engineering#	PC	NIL	5	3	0	2	4
5.	E3	Elective – III (PSE)	PSE	--	3	3	0	0	3
6.	E4	Elective – IV (PSE)	PSE	--	3	3	0	0	3
PRACTICALS									
7.	17CEP07	Design and Drawing Laboratory	PC	17CEC13	4	0	0	4	2
8.	17CEP08	Survey Camp*	PC	17CEC06	2	0	0	2	1
9.	17GED06	Comprehension	EEC	NIL	2	0	0	2	0
10.	17GED08	Essence of Indian Traditional Knowledge	EEC	NIL	2	2	0	0	0
				TOTAL	**34**	**20**	**4**	**10**	**24**

SEMESTER: VII									
SL. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17CEC20	Estimating ,Costing and Valuation#	PC	17CEP07	5	3	0	2	4
2.	17CEC21	Construction Techniques, Equipment and Practice	PC	NIL	3	3	0	0	3
3.	E5	Elective - V (PSE)	PSE	--	3	3	0	0	3
4.	E6	Elective - VI (PSE/ OE)	PSE/OE	--	3	3	0	0	3
5.	E7	Elective - VII (OE)	OE	--	3	3	0	0	3
PRACTICALS									
6.	17CED01	Design Project	EEC	--	8	0	0	8	4
7.	17CEP09	Industrial Training**	EEC	NIL	2	0	0	2	0
8.	17CEP10	Employability Skills – II	EEC	--	2	0	0	2	0
				TOTAL	**29**	**15**	**0**	**14**	**20**

SEMESTER: VIII									
SL. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	E8	Elective – VIII (PSE / OE)	PSE / OE	--	3	3	0	0	3
2.	E9	Elective – IX (OE)	OE	NIL	3	3	0	0	3
PRACTICALS									
3.	17CED02	Project Work	EEC	--	16	0	0	16	8
				TOTAL	**22**	**6**	**0**	**16**	**14**

Theory cum Practical Component

*Ten Days Survey Camp will be conducted during 5th semester winter vacation

** Industrial Training to be undergone during 3rd to 6th Semester Vacation – Minimum of 15 days duration

TOTAL CREDITS: 24 + 23 + 22 + 24 + 22 + 24+ 20 + 14 = 173

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REGULATIONS - 2017 **CHOICE BASED CREDIT SYSTEM**

B.E. CIVIL ENGINEERING

(A) HS,BS, and ES Courses

(a) Humanities and Social Sciences (HS) | Credit Distribution:12-14 | AICTE Norm:5 to 10%

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17EYA01	Professional English-I	HS	NIL	4	2	0	2	3	I
2.	17GEP01	Personal Values	HS	NIL	2	0	0	2	0	I
3.	17EYA02	Professional English-II	HS	17EYA01	4	2	0	2	3	II
4.	17GEP02	Inter Personal Values	HS	17GEP01	2	0	0	2	0	II

(b) Basic Sciences (BS) | Credit Distribution:17-30 | AICTE Norm:15 to 20%

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17MYB01	Calculus and Solid Geometry	BS	NIL	5	3	2	0	4	I
2.	17PYB01	Physics for Engineers	BS	NIL	3	3	0	0	3	I
3.	17CYB01	Applied Chemistry	BS	NIL	3	3	0	0	3	I
4.	17GYP01	Physics and Chemistry Laboratory	BS	NIL	4	0	0	4	2	I
5.	17MYB02	Complex Analysis and Laplace Transforms	BS	17MYB01	5	3	2	0	4	II
6.	17PYB03	Materials Physics	BS	17PYB01	3	3	0	0	3	II
7.	17CYB03	Environmental Science	BS	NIL	3	3	0	0	3	II
8.	17MYB03	Fourier Series and Partial Differential Equations	BS	NIL	4	2	2	0	3	III
9.	17MYB07	Numerical Methods	BS	NIL	3	2	2	0	3	IV

(c) Engineering Sciences (ES) | Credit Distribution:17-30 | AICTE Norm:15 to 20%

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17MEC01	Engineering Graphics	ES	NIL	4	2	2	0	3	I
2.	17CEC01	Fundamentals of Engineering Mechanics	ES	NIL	5	3	2	0	4	I
3.	17GYP02	Engineering Practices Laboratory	ES	NIL	4	0	0	4	2	I
4.	17EEC01	Basic Electrical and Electronics Engineering	ES	NIL	3	3	0	0	3	II
5.	17CSC01	Problem Solving and Python Programming	ES	NIL	3	3	0	0	3	II
6.	17CSP01	Problem Solving and Python Programming Laboratory	ES	NIL	4	0	0	4	2	II

7.	17CEP01	Building Drawing –I	ES	NIL	4	0	0	4	2	II
8.	17CEC03	Mechanics of Solids- I	ES	17CEC01	5	3	2	0	4	III
9.	17CEC07	Mechanics of Solids- II	ES	17CEC03	5	3	2	0	4	IV
10.	17CEP03	Building Drawing – II	ES	17CEP01	4	0	0	4	2	IV

(B) Programme Core Courses (PC)		Credit Distribution:63-72			AICTE Norm:30 to 40%					
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CEC02	Engineering Geology	PC	NIL	3	3	0	0	3	III
2.	17CEC04	Mechanics of Fluids	PC	NIL	3	3	0	0	3	III
3.	17CEC05	Building Materials#	PC	NIL	3	3	0	2	4	III
4.	17CEC06	Surveying	PC	NIL	3	3	0	0	3	III
5.	17CEP02	Survey Laboratory	PC	NIL	4	0	0	4	2	III
6.	17CEC08	Soil Mechanics#	PC	17CEC02	5	3	0	2	4	IV
7.	17CEC09	Highway Engineering	PC	NIL	3	3	0	0	3	IV
8.	17CEC10	Applied Hydraulics Engineering	PC	17CEC04	3	3	0	0	3	IV
9.	17CEC11	Concrete Technology	PC	17CEC05	3	3	0	0	3	IV
10.	17CEP04	Hydraulics Engineering Laboratory	PC	17CEC04	4	0	0	4	2	IV
11.	17CEC12	Structural Analysis – I	PC	17CEC01	5	3	2	0	4	V
12.	17CEC13	Design of Reinforced Concrete Elements	PC	NIL	5	3	2	0	4	V
13.	17CEC14	Foundation Engineering	PC	17CEC08	3	3	0	0	3	V
14.	17CEC15	Water Resources and Irrigation Engineering	PC	NIL	3	3	0	0	3	V
15.	17CEP05	Concrete and Highway Engineering Laboratory	PC	17CEC11	4	0	0	4	2	V
16.	17CEC16	Structural Analysis – II	PC	17CEC12	5	3	2	0	4	V
17.	17CEC17	Design Steel Structures	PC	17CEC03	5	3	2	0	4	VI
18.	17CEC18	Design of Reinforced Concrete Structures	PC	17CEC13	3	3	0	0	3	V
19.	17CEC19	Environmental Engineering#	PC	NIL	5	3	0	2	4	VI
20.	17CEP07	Design and Drawing Laboratory	PC	17CEC13	4	0	0	4	2	VI
21.	17CEP08	Survey Camp	PC	17CEC06	2	0	0	2	1	VI
22.	17CEC20	Estimating, Costing and Valuation#	PC	17CEP07	5	3	0	2	4	VII
23.	17CEC21	Construction Techniques and Equipment Practice	PC	NIL	3	3	0	0	3	VII

(C) Elective Courses										
(a)Program Specific Electives(PSE)			Credit Distribution:18-20		AICTE Norm:10 to 15%					
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CEX01	Architecture and Town Planning	PSE	--	3	3	0	0	3	V

2.	17CEX02	Remote Sensing and GIS Techniques	PSE	--	3	3	0	0	3	V, VI
3.	17CEX03	Construction Planning and Scheduling	PSE	--	3	3	0	0	3	V, VI, VII
4.	17CEX04	Traffic Engineering and Management	PSE	--	3	3	0	0	3	VI. VII
5.	17CEX05	Ground Improvement Techniques	PSE	--	3	3	0	0	3	VI, VII
6.	17CEX06	Housing Planning and Management	PSE	--	3	3	0	0	3	VII, VIII
7.	17CEX07	Railways, Airports and Harbour Engineering	PSE	--	3	3	0	0	3	IV, V, VI
8.	17CEX08	Green Buildings	PSE	--	3	3	0	0	3	VI, VII
9.	17CEX09	Smart Materials and Structures	PSE	--	3	3	0	0	3	V, VI, VII
10.	17CEX10	Industrial Waste Treatment and Disposal	PSE	--	3	3	0	0	3	V, VI
11.	17CEX11	Ground Water Engineering	PSE	--	3	3	0	0	3	VI, VII
12.	17CEX12	Solid Waste Management	PSE	--	3	3	0	0	3	VII, VIII
13.	17CEX13	Repair and Rehabilitation of Structures	PSE	--	3	3	0	0	3	VII, VIII
14.	17CEX14	Disaster Management and Mitigation	PSE	--	3	3	0	0	3	VI, VII
15.	17CEX15	Environmental Impact Assessment	PSE	--	3	3	0	0	3	V, VI
16.	17CEX16	Corrosion and its Control	PSE	--	3	3	0	0	3	VI
17.	17CEX17	Advanced Surveying Techniques	PSE	--	3	3	0	0	3	IV, V
18.	17CEX18	Digital Cadastre	PSE	--	3	3	0	0	3	VII
19.	17CEX19	Geoinformatics Applications for Civil Engineers	PSE	--	3	3	0	0	3	III, IV
20.	17CEX20	Pavement Engineering	PSE	--	3	3	0	0	3	IV, V
21.	17CEX21	Prestressed Concrete Structures	PSE	--	3	3	0	0	3	V, VII
22.	17CEX22	Computer Aided Design of Structures	PSE	--	3	3	0	0	3	VI, VII
23.	17CEX23	Prefabricated Structures	PSE	--	3	3	0	0	3	VI, VII
24.	17CEX24	Basics of Dynamics and Aseismic Design	PSE	--	3	3	0	0	3	VI, VII
25	17CEX25	Principles of Computational Fluid Dynamics	PSE	--	3	3	0	0	3	V, VI
26	17CEX26	Construction Safety	PSE	--	3	3	0	0	3	V, VI
26.	17GEA02	Principles of Management	PSE	--	3	3	0	0	3	VII
27.	17GEA03	Total Quality Management	PSE	--	3	3	0	0	3	V-VII
28.	17GEA04	Professional Ethics and Human Values	PSE	--	3	3	0	0	3	VI, VII

(b) (i) Open Electives			Credit Distribution:9-12		AICTE Norm:5 to 10%					
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY		CONTACT PERIODS	L	T	P	C	P.S
1.	17AGZ01	Baking and Confectionery Technology	OE	-	3	3	0	0	3	VII
2.	17AGZ02	Food safety and quality control system	OE	-	3	3	0	0	3	VII
3.	17AGZ03	Farm Mechanization	OE	-	3	3	0	0	3	VIII
4.	17AGZ04	Processing of Fruits and Vegetables	OE	-	3	3	0	0	3	VIII
5.	17CHZ01	Waste Water Treatment	OE	-	3	3	0	0	3	VII
6.	17CHZ02	Piping Engineering	OE	-	3	3	0	0	3	VII
7.	17CHZ03	Process Automation	OE	-	3	3	0	0	3	VII
8.	17CHZ04	Process Instrumentation	OE	-	3	3	0	0	3	VII
9.	17CEZ01	Energy conservation in buildings	OE	-	3	3	0	0	3	VII
10.	17CEZ02	Air Pollution Management	OE	-	3	3	0	0	3	VIII
11.	17CEZ03	Building Services	OE	-	3	3	0	0	3	VIII
12.	17CEZ04	Road Safety Management	OE	-	3	3	0	0	3	VII
13	17CEZ05	Waste Management	OE	-	3	3	0	0	3	VII/VIII
14.	17CSZ01	Design Thinking	OE	-	3	3	0	0	3	VII
15.	17CSZ02	Digital Marketing	OE	-	3	3	0	0	3	VII
16.	17CSZ03	Software Engineering	OE	-	3	3	0	0	3	VIII
17.	17CSZ04	Unified Functional Testing	OE	-	3	3	0	0	3	VIII
18	17CSZ05	C Programming	OE	-	3	3	0	0	3	VI
19.	17CSZ06	Data Structures	OE	-	3	3	0	0	3	VI
20.	17CSZ07	Web Services using Java	OE	-	3	3	0	0	3	VI
21.	17ECZ01	Modern wireless communication system	OE	-	3	3	0	0	3	VII
22.	17ECZ02	Consumer Electronics	OE	-	3	3	0	0	3	VII
23.	17ECZ03	Automotive Electronics	OE	-	3	3	0	0	3	VIII
24.	17ECZ04	Electronic Testing	OE	-	3	3	0	0	3	VIII

25.	17EEZ01	Renewable Energy Technology	OE	-	3	3	0	0	3	VII
26.	17EEZ02	Smart Grid	OE	-	3	3	0	0	3	VII
27	17EEZ03	Energy Auditing, Conservation and Management	OE	-	3	3	0	0	3	VIII
28	17EEZ04	Electrical Machines	OE	-	3	3	0	0	3	VIII
29	17EIZ01	Autotronix	OE	-	3	3	0	0	3	VII
30	17EIZ02	Industrial Automation	OE	-	3	3	0	0	3	VII
31.	17EIZ03	Fiber Optic Sensors	OE	-	3	3	0	0	3	VIII
32.	17EIZ04	Ultrasonic Instrumentation	OE	-	3	3	0	0	3	VIII
33.	17ITZ01	Software Testing Tool	OE	-	3	3	0	0	3	VII
34.	17ITZ02	User Experience	OE	-	3	3	0	0	3	VII
35.	17ITZ03	Developing Mobile Apps	OE	-	3	3	0	0	3	VIII
36.	17ITZ04	Software Project Management	OE	-	3	3	0	0	3	VIII
37.	17ITZ05	Java Programming	OE	-	3	3	0	0	3	VII
38.	17MEZ01	Engineering Ergonomics	OE	-	3	3	0	0	3	VII / VIII
39.	17MEZ02	Energy Audit and Resource Management	OE	-	3	3	0	0	3	VII / VIII
40.	17MEZ03	Electric Vehicle Technology	OE	-	3	3	0	0	3	VII / VIII
41.	17MEZ04	Value Engineering	OE	-	3	3	0	0	3	VII / VIII
42.	17MEZ05	Smart Mobility	OE	-	3	3	0	0	3	VII / VIII
43.	17MEZ06	Smart Sensor Systems	OE	-	3	3	0	0	3	VII / VIII
44.	17MYZ01	Mathematical Structures	OE	-	3	3	0	0	3	VII
45.	17MYZ02	Optimization Techniques	OE	-	3	3	0	0	3	VII
46.	17MYZ03	Statics for Engineers	OE	-	3	3	0	0	3	VII
47.	17MYZ04	Statistics for Engineers	OE	-	3	3	0	0	3	VII
48.	17PYZ01	Nanomaterials	OE	-	3	3	0	0	3	VII
49.	17PYZ02	Nuclear physics and Reactors	OE	-	3	3	0	0	3	VII

50..	17PYZ03	Space science and technology	OE	-	3	3	0	0	3	VII
51	17CYZ01	Chemistry for Every Day Life	OE	-	3	3	0	0	3	VII
52	17CYZ02	E - Waste Management	OE	-	3	3	0	0	3	VII
53	17CYZ03	Industrial Chemistry	OE	-	3	3	0	0	3	VII
54	17EYZ01	Communicative Hindi	OE	-	3	3	0	0	3	VII
55	17EYZ02	Fundamentals of German	OE	-	3	3	0	0	3	VII
56	17EYZ03	Basics of Japanese	OE	-	3	3	0	0	3	VII
57	17EYZ04	Employability Enhancement and Analytical Skills	OE	-	3	3	0	0	3	VII
58	17EYZ05	Workplace Communication	OE	-	3	3	0	0	3	VII
59.	17GYZ01	Biology for Engineers	OE	-	3	3	0	0	3	VII
60.	17BMZ01	Health care technology	OE	-	3	3	0	0	3	VII
61.	17BMZ02	Telemedicine	OE	-	3	3	0	0	3	VII
62.	17BMZ03	Epidemiology and Pandemic Management	OE	-	3	3	0	0	3	VII
63	17BMZ04	Medical Ethics	OE	-	3	3	0	0	3	VII
64	17EYX01	Effective Communication	OE	-	3	3	0	0	3	VII
65	17AIZ01	Fundamentals of artificial intelligence and machine learning	OE	-	3	3	0	0	3	VII
66	17AIZ02	Data science fundamentals	OE	-	3	3	0	0	3	VII
67	17AIZ03	Introduction to Business analytics	OE	-	3	3	0	0	3	VIII
68	17AIZ04	Augmented reality/virtual reality technologies	OE	-	3	3	0	0	3	VII
69	17ITZ06	Data structures using C	OE	-	3	3	0	0	3	VII
70	17ITZ07	Product Lifecycle Management for Engineers	OE		3	3	0	0	3	VII

b (ii) Additional Open Electives for Civil Engineering Program

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CSX31	Problem Solving and Programming	OE	-	3	3	0	0	3	V/VI
2.	17ITX26	Problem Solving and Algorithmic Skills	OE	-	3	3	0	0	3	V/VI

(D) Project			Credit Distribution:20		AICTE Norm:10 to 15%					
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CED01	Design Project	EEC	NIL	8	0	0	8	4	VII
2.	17CED02	Project Work	EEC	NIL	16	0	0	16	8	VIII

(E) Skill / Proficiency based courses(Not to be included in CGPA)			Credit Distribution: Non-Credit		AICTE Norm:3%					
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17GED01	Soft Skills - Listening and Speaking	EEC	NIL	2	0	0	2	0	III
2.	17GED02	Soft Skills - Reading and Writing	EEC	NIL	1	0	0	2	0	IV
3.	17GED03	Personality and Character Development	EEC	NIL	2	0	0	1	0	IV
4.	17CEP06	Employability Skills – I	EEC	NIL	2	0	0	2	0	V
5.	17GED07	Constitution of India	EEC	NIL	2	2	0	0	0	V
6.	17GED06	Comprehension	EEC	NIL	2	0	0	2	0	VI
7.	17GED08	Essence of Indian TraditionalKnowledge	EEC	NIL	2	2	0	0	0	VI
8.	17CEP09	Industrial Training **	EEC	NIL	2	0	0	2	0	VII
9.	17CEP10	Employability Skills – II	EEC	NIL	2	0	0	2	0	VII

Honor Degree Courses										
Vertical I - Construction Techniques and Practices										
S. NO.	COURSE CODE	COURSETITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CEX27	Sustainable Construction and Lean Construction	PSE	NIL	3	3	0	0	3	V-VII
2.	17CEX28	Energy Efficient Buildings	PSE	NIL	3	3	0	0	3	V- VII
3.	17CEX29	Modern Construction Materials	PSE	NIL	3	3	0	0	3	V- VII
4.	17CEX30	Advanced Construction Techniques	PSE	NIL	3	3	0	0	3	V- VII
5.	17CEX31	Construction Equipment Management	PSE	NIL	3	3	0	0	3	V- VII
6.	17CEX32	Resource Management in Construction	PSE	NIL	3	3	0	0	3	V- VII
7.	17CEX33	Quality Control in Construction	PSE	NIL	3	3	0	0	3	V- VII
8.	17CEX34	Intelligent building Techniques	PSE	NIL	3	3	0	0	3	V- VII

Vertical II - Water Resources										
S. NO.	COURSE CODE	COURSETITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CEX35	Earth and Rockfill Dams	PSE	NIL	3	3	0	0	3	V-VII
2.	17CEX36	Participatory Water Resources Management	PSE	NIL	3	3	0	0	3	V-VII

3.	17CEX37	Water Resources Systems Engineering	PSE	NIL	3	3	0	0	3	V-VII
4.	17CEX38	Watershed Conservation and Management	PSE	NIL	3	3	0	0	3	V-VII
5.	17CEX39	Integrated Water Resources Management	PSE	NIL	3	3	0	0	3	V-VII
6.	17CEX40	Urban Water Infrastructure	PSE	NIL	3	3	0	0	3	V-VII
7.	17CEX41	Water Quality and Management	PSE	NIL	3	3	0	0	3	V-VII
8.	17CEX42	Rainwater Harvesting	PSE	NIL	3	3	0	0	3	V-VII

Minor Degree Courses										
Environment and Sustainability										
S. NO.	COURSE CODE	COURSETITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CEM01	Sustainable Infrastructure Development	PSE	NIL	3	3	0	0	3	V-VII
2.	17CEM02	Green Technology	PSE	NIL	3	3	0	0	3	V- VII
3.	17CEM03	Materials for Energy Sustainability	PSE	NIL	3	3	0	0	3	V- VII
4.	17CEM04	Environment Ecology	PSE	NIL	3	3	0	0	3	V- VII
5.	17CEM05	Environmental Health and Safety	PSE	NIL	3	3	0	0	3	V- VII
6.	17CEM06	Introduction to Smart Cities	PSE	NIL	3	3	0	0	3	V- VII
7.	17CEM07	Disaster Preparedness and Planning	PSE	NIL	3	3	0	0	3	V- VII
8.	17CEM08	Energy Efficiency for Sustainable Development	PSE	NIL	3	3	0	0	3	V- VII

S. No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1.	HS	3	3	4						10
2.	BS	12	10	3	3					28
3.	ES	9	10	4	6					29
4.	PC			11	15	16	18	7		67
5.	PSE					6	6	6	3	21
6.	OE							3	3	6
7.	EEC	-	-	-	-	-	-	4	8	12
CREDITS TOTAL		**24**	**23**	**22**	**24**	**22**	**24**	**20**	**14**	**173**

17EYA01- PROFESSIONAL ENGLISH - I *(Common to All Branches)*					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To articulate and enunciate words and sentences clearly and efficiently using grammatical structures.	**1.1**	The students will be able to construct clear, grammatically correct sentences using a variety of sentence structures and appropriate vocabulary.	**i,j**
2.0	To acquire information through listening and apply it to persuade or articulate one's own point of view.	**2.1**	The students will be able to utilize listening skills to articulate one's own point of view in different circumstances.	**i,j,k,l**
3.0	To enable students to express themselves fluently and appropriately in social and professional contexts.	**3.1**	The students will be able to apply appropriate communication skills across settings, purposes, and audiences.	**i,j,k,l**
4.0	To summarize and paraphrase information in a text through reading skills.	**4.1**	The students will be able to distinguish main ideas and supporting details and employ active reading strategies to understand texts at the maximum level.	**i,j,l**
5.0	To understand different techniques and contents based on the written communication.	**5.1**	The students will be able to equip themselves with writing skills needed for academic as well as workplace contexts.	**i,j,k,l**

UNIT I - FOCUS ON LANGUAGE	**(6+6)**
Parts of Speech – Articles - Primary Auxiliaries – Modal Auxiliaries - Questions ('Yes/No' & 'Wh' Type) – Negatives - Prepositions – Conjunctions - Tenses (Simple, Continuous, Perfect, Perfect Continuous) - Vocabulary (Synonyms & Antonyms) - Homophones – Homonyms - One Word Substitution	
UNIT II - LISTENING FOR EFFECTIVENESS	**(6+6)**
Listening to Short Conversations or Monologues - Listening to Verbal and Non-Verbal Communication – Listening to Announcements - Listening and Note-taking – Listening to Telephonic Conversations – Listening to TED/ Ink talks- Intensive listening to fill in the gapped text	
UNIT III - COMMUNICATION BOOSTERS	**(6+6)**
Introducing Oneself – Exchanging Personal information (Likes & Dislikes) – Talking about Family & Friends - Asking about Routine Actions and Expressing Opinions - Participating in Short Conversations - Situational Talk	
UNIT IV - PROFESSIONAL READING	**(6+6)**
Skimming – Scanning (Short Texts and Longer Passages) – Inferring Technical Texts – Reading for Interrogation – Reading Newspaper, Advertisements and Interpreting – Practicing Speed Reading - Reading Comprehension (Multiple choice / Short / Open ended Questions) - Gap Filling	
UNIT V - TECHNICAL CORRESPONDENCE	**(6+6)**
Seeking Permission for Industrial Visit & In-plant Training – Checklist – Instruction - E-mail Writing - Report Writing (Accident & Survey)	

LIST OF SKILLS ASSESSED IN THE LABORATORY
1. Language Skills 2. Listening Skills 3. Speaking Skills 4. Reading Skills 5. Writing Skills
TOTAL (L:30, P:30) = 60 PERIODS

TEXT / REFERENCE BOOKS:

1. Sudharshana, N.P and Saveetha.C. “English for Technical Communication”. Cambridge University Press, New Delhi , 2016.
2. Jackman, Vanessa Russell and Whitehead. “Cambridge English Business Preliminary Practice Tests”. New Delhi: Oxford University Press, 2016.
3. Rizvi, Ashraf M. “Effective Technical Communication”. New Delhi: Tata McGraw Hill Publishing Company Limited, 2006.
4. Hewings, M. “Advanced English Grammar”. Chennai: Cambridge University Press, 2000.

17MYB01 - CALCULUS AND SOLID GEOMETRY *(Common to All Branches)*				
	L	**T**	**P**	**C**
	3	**2**	**0**	**4**

PREREQUISITE : NIL	**QUESTION PATTERN: TYPE - 4**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**
1.0	To develop the use of matrix algebra techniques those are needed by engineers for practical applications.	**1.1**	Apply the concept of orthogonal reduction to diagonalise the given matrix.	**a,b,c,e,g,i,k**
2.0	Use the techniques, Skills and Engineering tools necessary for engineering practice, with Geometric concepts.	**2.1**	Have knowledge about the geometrical aspects of sphere.	**a,b,c,e,f,i,k**
3.0	To improve their ability in solving geometrical applications of differential calculus problems.	**3.1**	Find the radius of curvature, circle of curvature and centre of curvature for a given curve.	**a,b,c,i,k**
4.0	To learn the important role of Mathematical concepts in engineering applications with the functions of several variables.	**4.1**	Classify the maxima and minima for a given function with several variables, through by finding stationary points.	**a,b,c,d,k**
5.0	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.	**5.1**	Demonstrate the use of double and triple integrals to compute area and volume.	**a,b,c,d,f,i,k**

UNIT I - MATRICES	**(9+6)**
Characteristic Equation-Eigen values and Eigen vectors of a matrix –Properties(statement only)- Cayley Hamilton Theorem and its applications- Orthogonal transformation of a symmetric matrix to a diagonal form - Quadratic form- Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNIT II - ANALYTICAL GEOMETRY OF THREE DIMENSIONS	**(9+6)**
Equation of a Plane –Angle between two planes-Equation of straight lines-Coplanar lines- skew lines- Equation of a sphere – Orthogonal spheres.	
UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**(9+6)**
Curvature – Curvature in Cartesian co-ordinates-Centre and Radius of curvature-Circle of curvature-Evolutes and Involutes-Envelopes.	
UNIT IV - FUNCTIONS OF SEVERAL VARIABLES	**(9+6)**
Partial derivatives - Euler's theorem on homogeneous function-Jacobian-Maxima and Minima of functions of two variables-Constrained Maxima and Minima by Lagrange's multiplier method.	
UNIT V - MULTIPLE INTEGRALS	**(9+6)**
Double integration in Cartesian Co-ordinates-Change of order of integration-Area as double integral- Triple integration in Cartesian Co-ordinates-Volume as triple integrals.	
TOTAL (L: 45+T:30) = 75 PERIODS	
Note : Simulation of Engineering Problems (Qualitative Analysis) using open source software	

TEXT BOOKS:

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd ed., Khanna publications, 2012.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th ed., John Wiley & sons, 2013.
3. Veerarajan.T, "Engineering Mathematics for Semester I & II ", 3rd ed., Tata McGraw Hill, 2014.

REFERENCES:

1. N.P.Bali, Manish Goyal, "A text book of Engineering Mathematics: Sem-II", 5th edi.,Laxmi Publications.2011.
2. Kandasamy .P, Thilagavathy .K , Gunavathy .K , "Engineering Mathematics for first Year", 9th Rv. Ed., S.Chand & Co Ltd, 2013.
3. Glyn James, "Advanced Engineering Mathematics", 7th ed., Wiley India, 2007.

17PYB01- PHYSICS FOR ENGINEERS *(Common to All Branches except CSE and IT)*				
L	T	P	C	
3	0	0	3	
PREREQUISITE : NIL	**QUESTION PATTERN: TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To provide the basic ideas in all the kinds of engineering branches	**1.1**	Acquire knowledge regarding Acoustics and ultrasonic	**a,b**
2.0	To develop the skills of the students in physics under various applications	**2.1**	Applying knowledge in the fields of optics & laser technology	**a,b**
3.0	To cultivate the censor designing ability of the students	**3.1**	Design the sensors using the knowledge of fiber optics	**a,b,e**
4.0	To provide knowledge in wave and particle physics	**4.1**	Gain the knowledge of wave, particle nature and matter waves	**a,b,e**
5.0	To provide the fundamental knowledge in basics of crystals	**5.1**	Analyze the different kind of crystal structures and crystal growth	**a,b**

UNIT I - ULTRASONICS AND ACOUSTICS **(9)**

Ultrasonics: Introduction - Properties of Ultrasonics- Magnetostriction and piezo electric methods. Measurement of velocity using acoustic grating- Ultrasonic A B C scan methods - Sonogram.

Acoustics: characteristics of musical sound – loudness – Weber – Fechner law – absorption coefficient – reverberation – reverberation time –Factors affecting acoustics of buildings and their remedies.

UNIT II - OPTICS AND LASER TECHNOLOGY **(9)**

Interference: Air wedge – theory – uses – testing of flat surfaces – determination of thickness of a thin wire.

Types of lasers – Nd – YAG laser – CO2 laser – semiconductor laser (homojunction & hetrojuction). Applications: Determination of particle size using laser - Holography – construction – reconstruction – Lasers in industry (Material Processing) and Medical field (Surgery)

UNIT III - FIBER OPTICS AND SENSORS **(9)**

Principle of light transmission through fiber - expression for acceptance angle and numerical aperture – Fabrication of optical fibers- Double crucible method - types of optical fibers (material, refractive Index profile and mode) fiber optic communication system. Splicing – Applications of optical fiber - Sensors- temperature- pressure sensor and displacement sensor Medical Endoscope.

UNIT IV - WAVE AND PARTICLE PHYSICS **(9)**

Development of quantum theory – de Broglie wavelength – properties of matter waves - G.P Thomson experiment - Schrödinger's wave equation – time dependent – time independent wave equations – physical significance – applications – particle in a one dimensional potential box - Compton Effect – theory and experimental verification.

UNIT V - CRYSTALLOGRAPHY	(9)
Lattice – unit cell – Bravais lattices – lattice planes – Miller indices – 'd' spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC and HCP structures – Crystal growth techniques- solution, melt (Czochralski) and vapour growth techniques(qualitative)	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. V. Rajendran," Engineering Physics", Tata McGraw-Hill, New Delhi, 2011.
2. G Senthilkumar. " Engineering Physics " VRB Publishers, 2011

REFERENCES:

1. P. K. Palanisami, " Physics for Engineers " Vol. 1, SciTech Pub. (India) Pvt. Ltd., Chennai, 2002.
2. M. N. Avadhanulu and P. G. Kshirsagar, "A Textbook of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2005
3. R. K. Gaur and S. L. Gupta, "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2006.

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17CYB01 - APPLIED CHEMISTRY
(Common to MECH, CIVIL, AGRI & CHEMICAL ENGG. Branches)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL	**QUESTION PATTERN: TYPE - 3**

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand the principles of water characterization and treatment methods.	**1.1**	Apply knowledge of fundamental principles of chemistry	**a,c**
2.0	To introduce the basic concepts of electrode potential and batteries	**2.1**	Define and solve engineering problems, including the utilization of creative and innovative skills	**a,b,c,g**
3.0	To understand the principles and applications of corrosion	**3.1**	Gain practical experience with chemical process equipment as well as to analyze and interpret data	**b,e**
4.0	To gain knowledge on engineering materials and industrial importance of fuels and combustion	**4.1**	Understand the impact of engineering solutions in a global, economic, environmental and societal content	**c,d,f,g**
5.0	To understand the concept of various analytical techniques	**5.1**	Understand the concept of engineering materials	**a,b,d,f,g, h**

UNIT I - WATER TECHNOLOGY	**(9)**

Hardness - types - estimation by EDTA method - Domestic water treatment - disinfection methods (chlorination, ozonation and UV treatment) - Boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) -Internal conditioning(carbonate, phosphate and calgon) - External conditioning - demineralization process - desalination - reverse osmosis method.

UNIT II - ELECTROCHEMISTRY	**(9)**

Electrochemistry - electrode potential - Nernst equation and problems - Reference electrode - standard hydrogen electrode - calomel electrode - potentiometric titration (redox) - conductometric titration (strong acid – strong base) - Batteries - types - lead acid battery – fuel cell – hydrogen and oxygen fuel cell.

UNIT III - CORROSION SCIENCE	**(9)**

Corrosion - definition – types - chemical and electrochemical corrosion (mechanism) – Galvanic corrosion – Differential aeration corrosion - Pitting corrosion – Factors influencing corrosion- Corrosion control - sacrificial anode method.

UNIT IV - FUELS AND COMBUSTION	**(9)**

Fuels -Solid fuels - coal - proximate analysis - metallurgical coke - manufacture by Otto-Hoffmann method - Liquid fuels - synthetic petrol - Fischer Tropsch and Bergius processes - knocking - octane number - cetane number - -Gaseous fuels - water gas - producer gas - Combustion - flue gas analysis - Orsat apparatus.

UNIT V - ANALYTICAL TECHNIQUES	**(9)**

Colorimetry - principles – estimation of Iron by colorimetry – UV–Visible spectroscopy – principles - instrumentation (block diagram only) - IR spectroscopy – principles - instrumentation (block diagram only) - Flame Photometry – principles - instrumentation (block diagram only) - estimation of sodium by flame photometry – Atomic absorption spectroscopy – principles - instrumentation (block diagram only) - estimation of nickel by atomic absorption spectroscopy.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. P.C. Jain.and Monica Jain, "Engineering Chemistry",Vol I & II, Dhanpat Rai Pub,Co., New Delhi,15th ed., 2013.
2. Dr.Ravikrishnan.A, "Engineering chemistry I & Engineering Chemistry II, Sri Krishna Hitech Publishing chem Co. Pvt Ltd., 13th ed., Chennai, 2014.

REFERENCES:

1. S.S. Dara, "A Text book of Engineering Chemistry",S.Chand & Co. Ltd., New Delhi, 2014.
2. N. Krishna murthy, D. Vallinayagam, "Engineering chemistry" PHI Learning Pvt Ltd., 2014.
3. B. Sivasankar, "Engineering Chemistry", Tata McGraw-Hill Pub. Co. Ltd., New Delhi ,2012.

17MEC01 - ENGINEERING GRAPHICS
(Common to All Branches except CSE and IT)

L	T	P	C
2	2	0	3

PREREQUISITE : NIL

QUESTION PATTERN: TYPE - 2

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To gain knowledge about conic sections and plane curves	**1.1**	The Students will be able to construct conic sections and special curves of required specifications	**a, c, d, e, i, k, l**
2.0	To learn the concept of first angle projection of points, lines and plane	**2.1**	The Students will be able to apply the concept of first angle projection to create project of straight lines, planes, solids and section of solids	**a, c, d, i, k, l**
3.0	To understand and familiarize with the projection of solids	**3.1**	The Students will be able to develop a surface drawing of a solid model with given dimensions	**a, c, d, e, i, k, l**
4.0	To learn the concept of sectioning of solids and developing the surfaces	**4.1**	The Students will be able to build orthographic, isometric projections of a three dimensional object	**a, c, d, i, k, l**
5.0	To understand the orthographic, isometric and perspective projections of three dimensional objects	**5.1**	The Students will be able to make use of the knowledge of engineering drawing to create physical models	**a, c, d, i, k, l**

CONCEPTS AND CONVENTIONS:

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning – Scales

UNIT I - PLANE CURVES **(6+6)**

Basic Geometrical constructions, Curves used in engineering practices - Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of square and circle - Drawing of tangents and normal to the above curves - Theory of Projection - Principle of Multi-view Orthographic projection - Profile plane and Side views - Multiple views - Representation of Three Dimensional objects - Layout of views

UNIT II - FIRST ANGLE PROJECTION OF POINTS, LINES AND PLANE **(6+6)**

Principal planes - First angle projection - Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method - Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III - PROJECTION OF SOLIDS **(6+6)**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method

UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **(6+6)**

Sectioning of solids (Prism, Cube, Pyramid, Cylinder and Cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V - ISOMETRIC, ORTHOGRAPHIC AND PERSPECTIVE PROJECTIONS	(6+6)

Principles of isometric projection - Isometric scale - Isometric projections of lines, plane figures, simple solids and truncated solids - Prisms, pyramids, cylinders, cones - combination of two solid objects in simple vertical positions - Free hand sketching of Orthographic views from Isometric views of objects. Perspective projection of simple solids - Cube, Prisms and pyramids by visual ray method

TOTAL (L:30+T:30) : 60 PERIODS

TEXT BOOKS:

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2013.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

REFERENCES:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th ed., 2010.
2. K.R.Gopalakrishna., "Engineering Drawing" (Vol I&II combined) Subhas Stores, Bangalore, 2007
3. K. V.Natarajan, "A text book of Engineering Graphics", 28th Edition, Dhanalakshmi Publishers, Chennai, 2015.
4. Dr. M. Saravanan, Dr. M. ArockiaJaswin and J. Bensam Raj, "Engineering Graphics", Tri Sea Publications.
5. Luzzader, Warren.J., and Duff, John M,"Fundamentals of Engineering Drawingwith an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy ed.,, Prentice Hall of India Pvt Ltd, New Delhi, 2005
6. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd ed., 2009

INSTRUMENT: ***Use of Mini drafter is compulsory***

Special points applicable to End Semester Examinations on Engineering Graphics:

1. The answer paper shall be of A3 size drawing sheets.
2. Minimum one question and not more than two questions from a unit.
3. Question paper consists of Part A and Part B.
4. Part A: One compulsory question carries 20 marks from any one of five units.
5. Part B: 4 out of 8 open choice questions carry 20 marks each.

17CEC01- FUNDAMENTALS OF ENGINEERING MECHANICS					
		L	T	P	C
		3	2	0	4
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To understand the scalar and vector representation of forces and moments.	**1.1**	Understand the Equilibrium of a particle and Forces in space		**a,b,f,i,k**
2.0	To apply static equilibrium of particles and rigid bodies in two dimensions	**2.1**	Analyze the problems in static equilibrium of particles and rigid bodies in two dimensions		**a,c,f,j**
3.0	Understand the meaning of centre of gravity (mass) / Centroid and Moment of Inertia	**3.1**	Evaluate various sectional properties like Centroid, Moment of Inertia		**a,d,i,k**
4.0	To communicate the solution to all problems in an organized and coherent manner and elucidate the meaning of the solution in the context of the problem	**4.1**	Identify with the laws of motion, the kinematics of motion and the interrelationship		**a,b,f,k**
5.0	To understand the principle of work and energy, laws of motion & kinematics of motion	**5.1**	Realize the effect of friction on equilibrium.		**a,b,c,i,l**

UNIT I - BASICS AND STATICS OF PARTICLES	**(9+6)**
Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem, Parallelogram and triangular Law of forces - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces.	
UNIT II - EQUILIBRIUM OF RIGID BODIES	**(9+6)**
Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments - Moment of a force about a point and about an axis - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions.	
UNIT III - PROPERTIES OF SURFACES AND SOLIDS	**(9+6)**
Determination of Areas and Volumes - Centre of Gravity - First moment of area, Second moment of area and Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia.	
UNIT IV - DYNAMICS OF PARTICLES	**(9+6)**
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – Work Energy Equation.	
UNIT V- FRICTION	**(9+6)**
Frictional force - Laws of Coulomb friction - Angle of friction - cone of friction - Simple contact friction - Ladder friction - Rolling Resistance - Problems involving the equilibrium of rigid bodies with frictional forces.	
	TOTAL (L:45+T:30) = 75 PERIODS

TEXT BOOKS:

1. Dr. N. Koteeswaran, “Engineering Mechanics”, Sri Balaji Publications, Coimbatore, 2013.
2. Dr. R. K. Bansal “A Textbook of Engineering Mechanics”, Laxmi Publications (P) Ltd, New Delhi, 6th ed., 2015.

REFERENCES:

1. M.S. Palanichamy and S. Nagam, “Engineering Mechanics - Statics & Dynamics”, 3rd ed., Tata McGraw-Hill, 2004.
2. S. Rajasekaran, G. Sankarasubramanian, “Fundamentals of Engineering Mechanics”, 3rd ed., Vikas Publishing House Pvt. Ltd, 2009.
3. F. P. Beer and E. R. Johnson, Vector Mechanics for Engineers, Vol I - Statics, Vol II Dynamics, 9th ed., Tata McGraw Hill, India, 2011
4. Irving H. Shames, “Engineering Mechanics - Statics and Dynamics”, 4th ed., Pearson Education Asia Pvt. Ltd., 2005.

17GYP01 - PHYSICS AND CHEMISTRY LABORATORY *(Common to All Branches Except CSE and IT)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PREREQUISITE: NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To provide the basic practical exposure to all the engineering and technological streams in the field of physics.	**1.1**	Acquire the fundamental knowledge in optics such as interference, Diffraction and Understand about the spectral instruments etc		**a,b,d,g,l**
2.0	To provide the basic practical exposure to all the engineering and technological streams in the field of chemistry.	**2.1**	Gain the basic knowledge about handling the laser light and Identify the basic parameters of an optical fibre		**a,b,d,g**
3.0	The students are able to know about the water containing impurities and some physical parameters	**3.1**	Analyze the properties of matter with sound waves		**a,b,d**
4.0	To gain the knowledge about light, sound, laser, fiber optics and magnetism	**4.1**	Apply knowledge of measurement of hardness producing ions, chloride, alkalinity, DO, conductance, EMF and pH		**a,b,d,g**
5.0	To develop the knowledge of conductometric titration and viscometry	**5.1**	Understand the impact of water quality and solve engineering problems		**a,b,d,g**

Physics Laboratory (Any Five – Branch specific)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

Chemistry Laboratory (Any Five)

1 Determination of total, temporary and permanent hardness of water by EDTA method.
2 Determination of alkalinity in water sample.
3 Determination of chloride content of water sample by argentometric method.
4 Conductometric titration of strong acid vs strong base.
5 Estimation of iron content of the given solution using potentiometer.
6 Determination of strength of given hydrochloric acid using pH meter
7 Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
8 Estimation of iron content of the water sample using spectrophotometer

TOTAL(P:60): 60 PERIODS

17GYP02 ENGINEERING PRACTICES LABORATORY *(Common to All Branches)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To provide hands on training on various basic engineering practices in Civil Engineering	**1.1**	The students will be able to understand various civil engineering practices like plumbing, carpentry and relevant tools	**a, d, f, i, k, l**	
2.0	To provide hands on training on various basic engineering practices in Mechanical Engineering	**2.1**	The students will be able to understand various manufacturing processes like welding, machining and sheet metal work	**a, d, f, i, k, l**	
3.0	To understand the basic working principle of electric components	**3.1**	The students will be able to do residential house wiring and Measure energy and resistance to earth of an electrical equipment	**a,e,f,h**	
4.0	To understand the basic working principle of electronic components	**4.1**	The students will be able to perform the assembling and testing of the PCB based electronic circuits.	**a,j,k,l**	
5.0	To develop the skill to make / operate/utilize the simple engineering components	**5.1**	The students will be able to make / operate / utilize the simple engineering components	**e, j**	

GROUP-A (CIVIL AND MECHANICAL ENGINEERING)

I - CIVIL ENGINEERING PRACTICE (15)

Buildings:

a. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects

Plumbing Works:

a. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings
b. Study of pipe connections requirements for pumps and turbines
c. Preparation of plumbing line sketches for water supply and sewage works
d. Hands-on-exercise:

   Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components
e. Demonstration of plumbing requirements of high-rise buildings

Carpentry using Power Tools only:

a. Study of the joints in roofs, doors, windows and furniture
b. Hands-on-exercise: Planning, Tee joints

II - MECHANICAL ENGINEERING PRACTICE (15)

Welding:

a. Preparation of edges for welding and study of welding symbols
b. Arc welding- butt joints, lap joints and tee joints
c. Gas welding
d. Study of standard size of bars, rods, sections, sheet metals
e. Study of work piece types and parameters of welding such as welding current, air gap, filler metal

Basic Machining:

a. Facing & Plain turning
b. Drilling Practice
c. Study of different types of screw drivers, screws, bolts and nuts

Sheet Metal Work:

a. Model making using bending and forming - Trays, cone
b. Study of thickness gauges, wire gauges

GROUP - B (ELECTRICAL AND ELECTRONICS)

I - ELECTRICAL ENGINEERING PRACTICE **(15)**

a. Residential house wiring using switches, fuse, indicator, lamp and energy meter
b. Fluorescent lamp wiring
c. Stair case wiring
d. Measurement of electrical quantities - voltage, current, power& power factor in RLC circuit
e. Measurement of energy using single phase energy meter
f. Measurement of resistance to earth of electrical equipment.

II - ELECTRONICS ENGINEERING PRACTICE **(15)**

a. Study of Electronic components - Resistor (Colour coding), Inductor, Capacitor.
b. Measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO.
c. Study of logic gates AND, OR, XOR and NOT.
d. Study of Clock Signal.
e. Soldering practice -Components Devices and Circuits - Using general purpose PCB.
f. Study of Half Wave Rectifier (HWR) and Full Wave Rectifier (FWR).
g. Study of Telephone, FM Radio and Cell Phone.

TOTAL(P:60): 60 PERIODS

17GEP01 - PERSONAL VALUES *(Common to All Branches)*					
			L	**T**	**P**	**C**
			0	**0**	**2**	**0**
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**	
1.0	To make students to learn individual in knowing them self	**1.1**	Become an individual in knowing the self	**a, f**	
2.0	To enable the student to understand Gratitude, Truthfulness, Punctuality, Cleanliness & fitness.	**2.1**	Acquire and express Gratitude, Truthfulness, Punctuality, Cleanliness &fitness.	**a, g**	
3.0	To enable the student to understand physical exercise and breathing techniques	**3.1**	Practice simple physical exercise and breathing techniques	**a, c**	
4.0	To make the students to Yoga asana which will enhance the quality of life.	**4.1**	Practice Yoga asana which will enhance the quality of life.	**a, c, f**	
5.0	To motivate the students to Practice Meditation and get benefited	**5.1**	Practice Meditation and get benefited.	**a, f**	

Values through Practical activities:

1.Knowing the self

Introduction to value education - Need & importance of Value education – Knowing the self – realization of human life – animal instinct vs sixth sense.

2. Mental Health

Evolution of senses – functioning steps of human mind – Body and Mind coordination - Analysis of thoughts – moralization of desires– autosuggestions – power of positive affirmations. – Meditation and its benefits.

3.Physical Health

Physical body constitution– Types of food - effects of food on body and mind – healthy eating habits – food as medicine– self healing techniques.

4.Core value Self love and Self care:

Gratitude - Happiness - Optimistic –Enthusiasm – Simplicity – Punctual - Self Control - Cleanliness & personal hygiene - Freedom from belief systems.

5.Fitness

Simplified physical exercises – Sun salutation - Lung strengthening practices: Naadi suddhi pranayama – Silent sitting and listening to nature – Meditation.

TOTAL(P:30): 30 PERIODS

REFERENCES:

1. Know Yourself — Socrates – pdf format at www.au.af.mil/au/awc/awcgate/army/rotc_self-aware.pdf.
2. Steps to Knowledge: the book of Inner Knowing – pdf format at www.newmessage.org/wp content/uploads/pdfs/books/stk_nkl_v1.5.pdf.
3. Promoting Mental Health - World Health Organization – pdf.
4. www.who.int/mental_health/evidence/mh_promotion_book.pdf
5. Learning to be: A Holistic and Integrated Approach to Values – UNESCO pdf format at www.unesdoc.unesco.org/ images/ 0012/001279/127914e.pdf
6. Personality Development by Swami Vivekananda -www.estudantedavedanta.net/personality- development.pdf

17EYA02 – PROFESSIONAL ENGLISH – II (Common to All Branches)				
L	T	P	C
2	0	2	3

PREREQUISITE : 17EYA01 | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To enable students to get familiar with words, phrases and sentences relevant to the immediate communication tasks.	**1.1**	The students will be able to communicate using a variety of sentence structures and appropriate vocabulary.	**i,j**
2.0	To help students to develop their listening skills and comprehend them by asking questions.	**2.1**	The students will be able to comprehend conversations and short talks delivered in English and respond accordingly.	**i,j,k,l**
3.0	To enhance students' speaking skills by making them to participate in Technical Presentation, Group Discussion, etc.	**3.1**	The students will be able to speak appropriately and effectively in various situations.	**i,j,k,l**
4.0	To inculcate reading habit and to develop effective reading skills.	**4.1**	The students will be able to employ active reading strategies to understand texts at the maximum level.	**i,j,l**
5.0	To foster the ability to write convincing Job Application and effective Formal Letters.	**5.1**	The students will be able to equip themselves with writing formal letters and winning Job Application.	**i,j,k,l**

UNIT I - LANGUAGE DEVELOPMENT	**(6+6)**
Vocabulary (Prefixes & Suffixes) - Active Voice and Passive Voice - Impersonal Passive Voice – Conditional Clauses – Subject - Verb Agreement - Direct and Indirect Speech - Idioms and Phrases - Discourse Markers - Error Spotting	
UNIT II – LISTENING COMPREHENSION	**(6+6)**
Listening for Specific Information and Match / Choose / Fill in the texts - Short Films, News, Biographies, Roles and Responsibilities in Corporate, Funny Shows – Listening to Iconic Speeches and making notes – Listening to Interviews	
UNIT III – ACQUISITION OF ORAL SKILLS	**(6+6)**
Describing a Person - Making Plans – Asking for and Giving Directions - Talking about Places - Talking over Phone – Narrating Incidents – Introduction to Technical Presentation - Story Telling – Group Discussion	
UNIT IV – READING NUANCES	**(6+6)**
Intensive Reading – Extensive Reading – Finding key information in a given text - Reading and Understanding Technical Articles - Reading and Interpreting Visual Materials	
UNIT V – EXTENDED WRITING	**(6+6)**
Job Application with Resume – Recommendation – Inviting Dignitaries - Accepting & Declining Invitation - Paragraph Writing (Topics and Images)	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. Language Skills.
2. Listening Skills.
3. Speaking Skills.
4. Reading Skills
5. Writing Skills

TOTAL (L:30+P:30) = 60 PERIODS

TEXT BOOKS: / REFERENCES:

1. Kumar, Suresh. E. "Engineering English". Orient Blackswan : Hyderabad, 2015.
2. Raman, Meenakshi and Sangeetha Sharma. "Technical Communication Principles and Practice", Oxford University Press: New Delhi, 2014.
3. Board of Editors. "Fluency in English – A Course Book for Engineering and Technology", Orient Blackswan: hyderabad, 2016.
4. Comfort, Jeremy, et al. "Speaking Effectively: Developing Speaking Skills for Business English". Cambridge University Press: Cambridge, 2011.

17MYB02 - COMPLEX ANALYSIS AND LAPLACE TRANSFORMS *(Common to All branches)*				
L	**T**	**P**	**C**
3	**2**	**0**	**4**

PREREQUISITE : 17MYB01	**QUESTION PATTERN : TYPE - 4**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		**Course Outcomes** The students will be able to	**Related Program outcomes**
1.0	To expose the concepts of differential equations.	**1.1**	Predict the suitable method to solve second and higher order differential equations.	**a,b,c,d,f,i,k**
2.0	To communicate the problem solutions using correct Mathematical terminology of vector calculus.	**2.1**	Apply the concepts of Differentiation and Integration to Vectors.	**a,b,c,f,g,k**
3.0	Apply rigorous and analytic approach to analyse the conformal mapping.	**3.1**	Compute an analytic function, when its real or imaginary part is known.	**a,b,c,d,e,i,k**
4.0	Acquiring the knowledge of evaluating contour integrals using residue theorem.	**4.1**	Identify the Singularities and its corresponding Residues for the given function.	**a,b,c,d,e,k**
5.0	Apply the concepts of Laplace transforms & its applications to various problems related to Engineering.	**5.1**	Predict a suitable method to evaluate the Contour integration.	**a,b,c,d,e,f,i,k**

UNIT I - ORDINARY DIFFERENTIAL EQUATIONS	**(9+6)**
Higher order linear differential equations with constant coefficients - method of variation of parameters - Cauchy's and Legendre's linear equations	
UNIT II - VECTOR CALCULUS	**(9+6)**
Gradient and Directional derivative -Divergence and Curl – Irrotational,solenoidal and scalar potential –Line integral over a plane curve-Surface Integral and Volume Integral-Green's theorem in a plane-Gauss divergence theorem and Stokes Theorem (Excluding Proofs)-Simple Applications Involving Square, Rectangles, Cube and Parallelopiped.	
UNIT III- ANALYTIC FUNCTIONS	**(9+6)**
Functions of a complex variable-Analytic functions– Necessary and sufficient conditions of Cauchy's -Riemann Equations in Cartesian Coordinates (Excluding Proofs) – Properties of Analytic Functions – Harmonic conjugate – Construction of an analytic function by Milne's Thomson Method– Conformal mapping :w = c+z , cz, 1/z and Bilinear Transformation.	
UNIT IV - COMPLEX INTEGRATION	**(9+6)**
Statement and Simple applications of Cauchy's integral theorem and Cauchy's integral formula(Excluding Proofs) – Taylor's and Laurent's Series Expansions - Singularities - Residues – Cauchy's Residue theorem (Statement only) – Evaluation of contour integration over unit circle and semi circle (Excluding poles on Real axis).	
UNIT V- LAPLACE TRANSFORM	**(9+6)**
Condition for existence - Transforms of Elementary functions –Basic Properties- First & Second Shifting Theorems (Statement only) –Transforms of derivatives and integrals- Transform of periodic functions - Initial and Final value Theorems. Inverse Laplace transforms -Convolution theorem (Statement only) –Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	
TOTAL (L: 45+T:30) = 75 PERIODS	

Note : Simulation of Engineering Problems (Qualitative Analysis) using open source software

TEXTBOOKS:

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley and sons, 2013
3. Veerarajan.T, "Engineering Mathematics for Semester I and II", 3rd Edition, Tata McGraw Hill, 2014

REFERENCES:

1. N.P.Bali and Manish Goyal, "A text book of Engineering Mathematics : Semester-II", 5th Edition, Laxmi Publications, 2011
2. Kandasamy .P, Thilagavathy .K and Gunavathy .K, "Engineering Mathematics for first Year", 9th Rv. Ed., S.Chand and Co Ltd, 2013
3. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, 2007

17PYB03 - MATERIALS PHYSICS
(Common to Civil and Mechanical Engineering branches)

L	T	P	C
3	0	0	3

PREREQUISITE : 17PYB01 | **QUESTION PATTERN : TYPE – 1**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes The students will be able to	Related Program outcomes
1.0	To provide the basic ideas in conduction in various materials.	**1.1**	Understand the electrical and thermal conduction in different materials.	**a,b,d**
2.0	To understand origin of magnetic field in materials and applications of magnetic materials as major storage devices.	**2.1**	Understand magnetic properties of materials and maneuver those materials for different applications.	**a,b,d**
3.0	To gain fundamental knowledge about thermal physics and that will help students to study further subjects like thermodynamics, heat and mass transfer etc	**3.1**	Understand the various form of heat conduction and thermal conductivity of good and bad Conductors.	**a,b,d**
4.0	To update the modern techniques for the analysis of physical properties of solids.	**4.1**	Examine the materials using different methods during the manufacturing process.	**a,b,d,l**
5.0	To update the recent developments in smart materials and mechanical properties.	**5.1**	Acquire information regarding new engineering materials and mechanical properties.	**a,b,d,l**

UNIT I - CONDUCTION IN MATERIALS **(9)**

Conductors: Electron theories of conductivity - postulates of classical free electron theory- derivation of electrical and thermal conductivity of metals -Weidman-Franz law verification - merits and demerits. Semiconductors: Elemental and compound semiconductors - Intrinsic and Extrinsic semiconductors (qualitative) – Hall effect –determination of Hall coefficient – Applications.

Superconductivity: Properties - Types of super conductors – BCS theory of superconductivity.

UNIT II - MAGNETIC MATERIALS **(9)**

Origin of magnetic moment – Bohr magneton – Types of magnetic materials – Domain theory – Hysteresis – soft and hard magnetic materials. Ferrites – applications – magnetic recording and readout – tapes, floppy and magnetic disc drives.

UNIT III - THERMAL PHYSICS **(9)**

Mode of heat transfer-thermal conductivity-Newton's law of cooling -thermal conduction through compound media (bodies in series and parallel) - thermal conductivity of a good conductor – Forbe's method-thermal conductivity of bad conductor-Lee's disc - radial flow of heat-expression for thermal conductivity of rubber-experimental determination-practical applications of conduction.

UNIT IV - MATERIAL TESTING MECHANISMS **(9)**

Testing of materials – classification of tests – destructive test – tensile test on a metal – hardness test – Non Destructive Testing-Various steps involved in NDT process- X-ray radiographic technique – displacement method – merits, demerits and application of X-ray radiography – X-ray fluoroscopy – liquid penetrant method – advantages, disadvantages and application.

UNIT V - MECHANICAL PROPERTIES OF MATERIALS AND SMART MATERIALS	(9)

Metallic glasses: preparation, properties and applications. Shape Memory Alloys (SMA): Characteristics, properties of Ni-Ti alloy, application, advantages and disadvantages of SMA.

Mechanical properties of materials: Tension, Compression, Shear and Torsional Test of Metals -Stress-strain behavior of ferrous & non-ferrous metals, polymer and ceramics - True stress and strain relations.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Rajendran.V, "Engineering Physics", Tata McGraw-Hill, New Delhi.2011.
2. Gaur.R.K, Gupta.S.L, "Engineering Physics", DhanpatRai Publications, 2007.
3. Raghavan, V., "Material Science and Engineering", 5th ed., Prentice-Hall of India, 2004

REFERENCES:

1. SenthilKumar.G, N.Iyandurai, "Physics-II", VRB Publishers, Revised ed., 2005-2006,
2. Pillai.S.O, "Solid State Physics", New Age International Publications, New Delhi, 2010.

17CYB03 - ENVIRONMENTAL SCIENCE *(Common to All Branches)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE – 3**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**	
1.0	To understand the constitutes of the environment	**1.1**	Design a system, component, or process to meet desired needs.	**a,b,c,e,h**	
2.0	The students should be conversant with valuable resources.	**2.1**	Identify, formulate, and solve environmental engineering problems.	**a,b,c,f,g**	
3.0	To know about the role of a human being in maintaining a clean environment.	**3.1**	Understand the professional and ethical responsibility as related to the practice of environmental engineering and the impact of engineering solutions in a global context.	**a,b,c,f,g**	
4.0	To maintain ecological balance and preserve bio-diversity.	**4.1**	Use the techniques, skills, and modern engineering tools necessary for environmental engineering practice.	**a,b,c,e,g**	
5.0	To get knowledge about the conservation of environment for the future generation.	**5.1**	Acquire the knowledge of information technology in environmental science.	**a,l**	

UNIT I - INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES	**(9)**
Environment: Scope – importance - need for public awareness - Forest resources - Use-over exploitation-deforestation - Water resources - use-over utilization of surface and ground water - conflicts over water - Mineral resources - use-exploitation-environmental effects of extracting and using mineral resources - Food resources - world food problems changes caused by agriculture - Effects of modern agriculture - fertilizer- pesticide problems - Energy resources - Renewable energy sources - solar energy - wind energy. Land resources - land degradation - soil erosion - Role of an individual in conservation of natural resources.	
UNIT II - ECOSYSTEMS AND BIODIVERSITY	**(9)**
Concepts of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Food chains- food webs - types of ecosystem - structure and functions of forest ecosystem and river ecosystem – Biodiversity - value of biodiversity - consumptive use-productive use - social values - ethical values - aesthetic values - Hotspots of biodiversity -Threats to biodiversity - Habitat loss - poaching of wildlife and man wildlife conflicts- Conservation of biodiversity - In-situ and Ex-situ conservation of biodiversity.	
UNIT III - ENVIRONMENTAL POLLUTION	**(9)**
Pollution: Causes - effects and control measures of Air pollution - Water pollution - Soil pollution and Noise pollution - Solid waste management - Causes - effects -control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster managements - Floods - cyclone- landslides.	
UNIT IV - SOCIAL ISSUES AND THE ENVIRONMENT	**(9)**
Water conservation - rain water harvesting - global warming - acid rain - ozone layer depletion - Environment protection act - Air (Prevention and control of pollution) Act - Water (prevention and control of pollution) Act - Green Chemistry – Principle of Green chemistry – Application of Green chemistry.	

UNIT V - HUMAN POPULATION AND THE ENVIRONMENT	(9)
Population growth - variation among nations - Population explosion - Family welfare programme - Human rights - HIV/AIDS – Human health and environment - women and child welfare - Role of information technology in environment and human health.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Anubha Kaushik and C.P. Kaushik, "Environmental Science and Engineering", New Age International Publishers, New Delhi, 2015.
2. Dr. A.Ravikrishan, "Envrionmental Science and Engineering", Sri Krishna Hitech Publishing co. Pvt. Ltd., Chennai,12th ed., 2016.

REFERENCES:

1. Masters, Gilbert M, "Introduction to Environmental Engineering and Science", 2nd ed., Pearson Education, New Delhi ,2012.
2. Santosh Kumar Garg, Rajeshwari garg, smf Ranjni Garg,"Ecological and Environmental Studies",Khanna Publishers, Nai Sarak, Delhi, 2014.
3. Miller T.G. Jr., "Environmental Science", 10th ed., Wadsworth Publishing Co. 2015.

17EEC01- BASIC ELECTRICAL AND ELECTRONICS ENGINEERING *(Common to AGRI. , CIVIL and Chemical Branches)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL	**QUESTION PATTERN : TYPE - 3**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**
1.0	To impart knowledge on electric circuit laws, single phase circuits and measuring instruments.	**1.1**	Apply the basic laws and investigates the behavior of electric circuits by analytical instruments.	**a,b,d,f**
2.0	To learn the basic principles of electrical machines and their performance.	**2.1**	Identify the electrical components and explore the characteristics of electrical machines.	**a,b,d,f**
3.0	To expound the fundamentals of semiconductor and applications.	**3.1**	Analyze the various characteristics of semiconductor devices and applications.	**a,b,c,e,f**
4.0	To introduce the fundamentals of digital circuits, combinational and sequential circuit.	**4.1**	Expose the concept of digital electronics	**a,c,e,f**
5.0	To impart knowledge on communication systems.	**5.1**	Understand the fundamental of communication systems.	**a,c,e,f**

UNIT I - ELECTRICAL CIRCUITS AND MEASURMENTS	**(9)**
Ohm's Law – Kirchhoff's Laws – Mesh and Nodal analysis– Introduction to AC circuits – Power and Power factor - Classification of instruments – Operating principles of moving coil, moving iron instruments and dynamometer type wattmeter - Induction type energy meter.	
UNIT II - ELECTRICAL MACHINES	**(9)**
DC Generator - DC Motor - Single phase transformer - Single phase induction motor: construction, principle of operation, basic equations and applications.	
UNIT III - SEMICONDUCTOR DEVICES AND APPLICATIONS	**(9)**
Introduction - Characteristics of PN junction diode and Zener diode – Half wave and Full wave rectifier – Bipolar junction transistor: CB, CE, CC configurations and characteristics.	
UNIT IV - DIGITAL ELECTRONICS	**(9)**
Binary number system - Logic gates – Boolean laws –Half and Full adders – Introduction to sequential circuits: Flip-Flops (RS, D, T and JK), shift registers and counters - ADC and DAC.	
UNIT V - FUNDAMENTALS OF COMMUNICATION ENGINEERING	**(9)**
Introduction - Elements of communication systems - Amplitude and Frequency modulation -Demodulation - Communication systems: Radio, TV, ISDN, Microwave, Satellite and Optical fibre. (Block Diagram Approach only)	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016.
2. R.Muthusubramaian, S.Salivahanan and K.A.Muraleedharan, "Basic Electrical, Electronics and Computer Engineering", 2nd ed., Tata MCGraw Hill. 2012.

REFERENCES:

1. Sedha R.S., “Applied Electronics”, S. Chand & Co., 2008.
2. Mittle and V. N. Mittle, “Basic Electrical Engineering”, Tata McGraw Hill , New Delhi, 2005.
3. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson India, 2011.
4. Nageswara Rao.T, “Circuit Theory”, A.R. Publications, Chennai, 2014.

17CSC01 - PROBLEM SOLVING AND PYTHON PROGRAMMING *(Common to Civil, Mech., Agri. & Chemical Branches)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To gain knowledge about the basics of computer	**1.1**	The students will be able to understand the working of computers	**a, c, j, k**
2.0	To educate about problem solving strategies	**2.1**	The Students will be able to identify the electrical components and explore the characteristics of electrical machines	**a, c, j**
3.0	To impart the fundamental concepts of Python Programming	**3.1**	The Students will be able to identify the various electronic devices and understand the principles of working of the semiconductor devices.	**a, b, c, j, k**
4.0	To gain exposure about string manipulation, list, and tuples	**4.1**	The Students will be able to explain the working of Rectifiers, Filters and Amplifiers.	**a, b, c, k**
5.0	To get knowledge about dictionaries, function and modules	**5.1**	The Students will be able to choose appropriate instruments for electrical measurement for a specific application.	**a, b, c, k**

UNIT I - BASICS OF COMPUTERS	**(9)**
Computer Basics - Applications and characteristics of Computer – Generations of Computers - Computer organization - Computer Software -Types of software - Software Development steps – Basic Internet Terminologies.	
UNIT II - PROBLEM SOLVING STRATEGIES	**(9)**
Number System and Arithmetic - Algorithms, building blocks of algorithms (instructions/statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), simple strategies for developing algorithms (iteration, recursion). – Programming Errors – Programming Paradigm.	
UNIT III - INTRODUCTION TO PYTHON	**(9)**
History – Features – Execution of python program – Flavors of Python – Comments - Data Types - Built-in data types– Sequences - Literals– Operators – Input and Output Statements - Conditional Statements : if – if-else – Nested if-else – For – While – Nested loops – Break – Continue - pass - assert - return	
UNIT IV - STRINGS, LISTS AND TUPLES	**(9)**
Strings and Characters: Creating – Length – Indexing – Slicing – Repeating – Concatenation – Comparing - Removing Spaces - Finding Sub Strings - Counting Substrings in a String - Strings are Immutable - Replacing a String with another String - Splitting and Joining Strings - Changing Case of a String - Checking Starting and Ending of a String - Formatting the Strings - Working with Characters - Sorting Strings - Searching - Finding Number. Lists: Creating Lists – Updating - Concatenation - Repetition - Methods – Sorting. Tuples: Creating - Accessing – Operations – Functions - Nested Tuples - Inserting Elements, Modifying Elements, Deleting Elements from a Tuples.	

UNIT V - DICTIONARIES AND FUNCTIONS	(9)
Dictionaries: Operations – Methods - Using for Loop with Dictionaries – Sorting the Elements of a Dictionary using Lambdas - Converting Lists and Strings into Dictionary - Passing Dictionaries to Functions - Ordered Dictionaries. Functions: Defining – Calling – Returning - Pass by Object Reference – Formal, Actual, Positional, Keyword, Default & Variable Length Arguments - Local and Global Variables - Recursive Functions - Lambdas - Function Decorators.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Ashok.N.Kamthane, - Computer Programming, 2nd ed., Pearson Education (India), 2012.
2. Dr. R. Nageswara Rao, - Core Python Programming, Dreamtech Press, ed., 2017

REFERENCES:

1. Kenneth A. Lambert, - Fundamentals of Python: First Programs, Cengage Learning, 2012.
2. Wesley J. Chun, - Core Python Programming, Pearson Education, 2nd ed., 2010.

17CSP01 - PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY *(Common to Civil, Mech., Agri. & Chemical Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To identify and understand word document and excel sheets.	**1.1**	The student will be able to use MS Word and MS Excel for document preparation.	**a, c, j**
2.0	To impart the fundamental concepts of Python Programming	**2.1**	The students will be able to understand the basics of Python Programming constructs	**a, b, k**
3.0	To gain exposure about string manipulation, list, and tuples	**3.1**	The students will be able to realize the need of string manipulation, list, and tuples	**a, b, c, i, k**
4.0	To get knowledge about dictionaries, function and modules	**4.1**	The students will be able to design programs involving dictionaries, function and modules.	**a, b, c, i, k**
5.0	To learn about exception handling	**5.1**	The students will be able to develop simple programs with exception handling	**a, b, e, i**

Word Processing

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation

Spread Sheet

4. Chart - Line, XY, Bar and Pie.
5. Formula - formula editor

RAPTOR –Tool

6. Drawing - flow Chart

Python-Programming

7. Program Using Operators
8. Program Using Conditional Statements
9. Program Using Looping
10. Program Using Strings
11. Program Using Lists
12. Program Using Dictionaries
13. Program Using Functions

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

Hardware

LAN System with 33 nodes (OR) Standalone PCs – 33 Nos, Printers – 3 Nos.

Software

OS – Windows / UNIX Clone

Application Package – Office suite

RAPTOR –Tool

TOTAL(P:60) = 60 PERIODS

17CEP01 -BUILDING DRAWING - I					
		L	T	P	C
		0	0	4	2
PRE REQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**	
1.0	To Study about the Software capabilities for drafting and modeling	**1.1**	Capability to draw the simple figures and its types	**a,b,c,d,e,j,k,l**	
2.0	To draw the polygons and multiline figures	**2.1**	Knowledge to create the simple solids like prism pyramids etc.	**a,b,e,j,l**	
3.0	To study the different types of buildings & their views	**3.1**	Ability to draw the plan of the different buildings	**a,b,c,j,**	
4.0	To draw the Isometric, 2D and 3D views of the simple objects	**4.1**	Expert in isometric, 2D and 3D views of simple objects like cone, prism	**a,b,e,g,j,k,l**	
		5.1	To identify the symbols and sign conventions in construction.	**a,b,c,e,g,j,l**	

LIST OF EXPERIMENTS:

1. **INTRODUCTION TO BASIC COMMANDS:** Introduction to computer aided drawing, co-ordinate systems, reference planes and commands.
2. **SYMBOLS AND SIGN CONVENTIONS** : Materials, Architectural, Electrical and Plumbing symbols
3. **BUILDINGS WITH LOAD BEARING WALLS** (Plan only) - Flat roof and Sloped roof.
4. **JOINERY DETAILS**: **DOORS** - Flush and Partially Glazed Door.
   WINDOWS - Windows with and without mullion
5. **INDUSTRIAL BUILDINGS** - Types of Simple Steel Trusses.
6. **PLANNING OF BUILDINGS** - Plan, elevation and section of single storied residential building with flat RCC roof and brick masonry walls having not more than 2 rooms.

TOTAL (P:60) : 60 PERIODS

TEXT BOOKS:

1. Subhash C Sharma & Gurucharan Singh, "Civil Engineering Drawing", Standard Publishers, 7th ed., 2014.
2. B.P. Verma, "Civil Engineering Drawing", Khanna Publishers, New Delhi, 2006.

REFERENCES:

1. Dr. N. Kumara Swamy, A. Kameswara Rao. "Building Planning and Drawing", Charotar Publishing House Pvt. Ltd., 7th ed., 2014
2. V.B Sikka, "A Course in Civil Engineering Drawing", S.K. Kataria & Sons, Delhi, 2012.

17GEP02- INTER PERSONAL VALUES *(Common to All Branches)*					
		L	T	P	C
		0	0	2	0
PREREQUISITE: 17GEP01					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To know interpersonal values	**1.1**	Develop a healthy relationship & harmony with others		**L**
2.0	To train the students to maneuver their temperaments.	**2.1**	Practice respecting every human being		**f,l**
3.0	To achieve the mentality of appreciating core values of a person.	**3.1**	Practice to eradicate negative temperaments		**j,k,l**
4.0	To analyze the roots of problems and develop a positive attitude about the life.	**4.1**	Acquire Respect, Honesty, Empathy, Forgiveness and Equality		**j,l**
5.0	To understand the effects of physical activities on mental health.	**5.1**	Practice Exercises and Meditation to lead a healthy life and Manage the cognitive abilities of an Individual		**L**

UNIT I – INTRODUCTION	**(6)**
Introduction to interpersonal values - developing harmony with others - healthy relationship - need and importance of interpersonal values for dealing with others and team - effective communication with others.	
UNIT II - MANEUVERING THE TEMPERAMENTS	**(6)**
From Greed To Contentment - Anger To Tolerance - Miserliness To Charity - Ego To Equality - Vengeance To Forgiveness.	
UNIT III - CORE VALUE	**(6)**
Truthfulness - Honesty - Helping - Friendship - Brotherhood - Tolerance - Caring and Sharing - Forgiveness - Charity - Sympathy - Generosity - Brotherhood - Adaptability.	
UNIT IV - PATHWAY TO BLISSFUL LIFE	**(6)**
Signs of anger - Root cause - Chain reaction - Evil effects on Body and Mind - Analyzing roots of worries - Techniques to eradicate worries.	
UNIT V - THERAPEUTIC MEASURES	**(6)**
Spine strengthening exercises - Nero muscular breathing exercises - Laughing therapy - Mindfulness meditation.	
	TOTAL (P:30) = 30 PERIODS

REFERENCES:

1. Interpersonal Skills Tutorial (Pdf Version) – TutorialsPoint www.tutorialspoint.com/interpersonal_skills/interpersonal_skills_tutorial.pdf
2. Interpersonal relationships at work - Ki Open Archive – Karolinska www.publications.ki.se/xmlui/bitstream/handle/10616/39545/thesis.pdf?sequence=1
3. Values education for peace, human rights, democracy – UNESCO. www.unesdoc.unesco.org/images/0011/001143/114357eo.pdf
4. Maneuvering Of Six Temperaments - Vethathiri Maharishi. www.ijhssi.org/papers/v5(5)/F0505034036.pdf
5. The Bliss of inner fire: Heart practice of the six. – Wisdom Publications - www.wisdompubs.org/sites/.../Bliss%20of%20Inner%20Fire%20Book%20Preview.pd

17MYB03 - FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS (Common to BE - MECH / CIVIL / CHEMICAL / AGRI)					
		L	**T**	**P**	**C**
		2	**2**	**0**	**3**
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE – 4**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**	
1.0	To acquire knowledge to solve half range Fourier series and harmonic analysis.	**1.1**	Ability to have fundamental understanding of Fourier series and give Fourier expansions of a given function.	**a,b,c,d,k,l**	
2.0	To understand the concept of Fourier transforms and enhance the problem solving skill.	**2.1**	Apply transform techniques to solve engineering problems.	**a,b,c,f,g**	
3.0	To introduce how to solve linear partial differential equations with different methods.	**3.1**	Analyze and simulate the first and second order linear partial differential equations.	**a,b,c,i,k,l**	
4.0	To get the analytical solution for second and higher order homogeneous linear PDE's.	**4.1**	Demonstrate a firm understanding of the solution techniques for homogeneous linear PDE's.	**a,b,c,d,e,l**	
5.0	To solve different forms of wave and heat equations.	**5.1**	Ability to apply partial differential techniques to solve the physical engineering problems.	**a,b,c,d,k**	

UNIT I - FOURIER SERIES	**(6+6)**
Dirichlet's conditions - Fourier series: Half range sine series - Half range cosine series - Parseval's identity for half range series - Root -Mean square value of a function - Harmonic Analysis (π, degree and T- forms).	
UNIT II - FOURIER TRANSFORMS	**(6+6)**
Fourier integral theorem (statement only) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem.	
UNIT III - FIRST ORDER NON LINEAR PARTIAL DIFFERENTIAL EQUATIONS	**(6+6)**
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of standard types of first order partial differential equations: (i) f(p,q)=0, (ii) Clairaut's type, (iii) f(z,p,q) = 0, (iv) f(x,p) = g(y,q).	
UNIT IV - LINEAR PARTIAL DIFFERENTIAL EQUATIONS	**(6+6)**
General solution of Lagrange's linear equation Pp+Qq = R - Solutions of simultaneous equations dx/P=dy/Q =dz/R by the method of grouping & method of multipliers-Homogeneous linear partial differential equations of second and higher order with constant coefficients (R.H.S = 0, e^{ax+by}, cos(ax+by), sin(ax+by), $x^r y^s$).	
UNIT V - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	**(6+6)**
Classification of second order quasi linear partial differential equations - Solutions of one dimensional wave equation(zero and Non-zero Boundary conditions) - One dimensional heat equation(Reduced to zero & non zero temperature)- Steady state solution of two dimensional heat equation (Finite and infinite plate).	
TOTAL (L: 30+T:30) = 60 PERIODS	

TEXT BOOKS:

1. Veerarajan,T. " Transforms and Partial Differential Equations", 2nd ed., Tata Mc Graw Hill, New Delhi, Second reprint, 2015.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K**.,** "Engineering Mathematics; Volume III", S. Chand & Co Ltd., 2008.

REFERENCES:

1. Goyal. Manish ansd Bali, N.P, "A Textbook of Engineering mathematics", 6th ed., Laxmi Publication (P) Ltd. New Delhi, 2012.
2. Grewal, B.S. "Higher Engineering Mathematics", 42nd ed. Khanna publishers, New Delhi, 2012.
3. Kreyszig, Erwin. "Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.

17CEC02 - ENGINEERING GEOLOGY			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN: TYPE – 3

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart the concepts of geological agents and their processes.	1.1	Identify the available minerals by their properties and behaviour	b,d
2.0	To provide knowledge on various properties of minerals and their engineering significance.	2.1	Acquire the knowledge of the topographical formation, interior earth and also the theory of plate tectonics.	a,e,g
3.0	To give knowledge on various classifications of rocks.	3.1	Identify various geological agents and processes involved.	e,g
4.0	To understand the importance of geological investigations and mapping.	4.1	Study the characteristics of ground water	e,l
5.0	To understand the importance of geological hazards	5.1	Do geological investigations and mapping for construction projects	a,b,i,l

UNIT I - MINERALS AND ROCKS	(9)
Relevance and importance of Engineering Geology of Civil Engineers, Minerals, their physical properties - rock forming minerals, physical and engineering properties of igneous, metaphoric and sedimentary rocks.	
UNIT II - INTERIOR AND STRUCTURES OF EARTH	**(9)**
Earth's interior based on seismic models, plate tectonics and continental drift, study of earth's structures - fold, faults and joints, geological factors affecting Civil Engineering constructions, geological maps, and their uses.	
UNIT III - WEATHERING AND SOILS	**(9)**
The atmosphere, rock decay and weathering, soil origin and formation – classification and its engineering importance, slope stability – rock and soil slopes stability analysis –landslides - cause and remedial measures.	
UNIT IV- GROUND WATER	**(9)**
Characteristic of ground water, hydro-geological cycle, types of aquifers, water level fluctuations, surface and subsurface geophysical methods, groundwater contamination, artificial recharge of groundwater and harvesting of rainwater	
UNIT V- EARTH PROCESSES AND REMOTE SENSING	**(9)**
Brief description on - geological hazards -cause and formation of flood, cyclone, Volcano- Earthquake, tsunami - Introduction to remote sensing and Geographical Information System	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Chenna Kesavulu.N, "Textbook of Engineering Geology", 2nd ed., Macmillan Publishers, India Ltd., 2009.
2. Parbin Singh, "Engineering & General Geology", 7th ed., S.K.Kataria and Sons, New Delhi, 2010.

REFERENCES:

1. Blyth - F.G.H. Edward Arnold, "A Geology for Engineers", 7th ed., Great Britain by Biddies Ltd., King's Lynn, Norfolk, 2008.
2. David.K, Todd John Wily & Sons Inc, "Ground Water Hydrology" 3rd ed., New York, 2005.
3. Garg.S.K, "Physical and Engineering Geology", Khanna Publishers, Delhi, 2004

17CEC03 - MECHANICS OF SOLIDS – I				
L	T	P	C	
3	2	0	4	

PREREQUISITE : 17CEC01 | **QUESTION PATTERN: TYPE -4**

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To know fundamental concepts of stress, strain and deformation of solids with applications to bars and beams	**1.1**	Study the concepts of stress ,strain and deformation of solids	**a.b.l**
2.0	To analyze plane truss and determine the deflection of beams	**2.1**	Analyze the plane truss members using various methods	**a,b,l**
3.0	To draw the bending moment and shear force diagram for different types of beams.	**3.1**	Able to draw the bending moment and shear force diagram	**a,b,c,i,l**
4.0	To calculate the deflection of beams by various methods	**4.1**	Analyze the slope and deflection of beams by various methods	**a,b,d**
5.0	To study the concepts of theory of torsion and springs	**5.1**	Understand the concept of stresses in shafts and springs	**a,b,e**

UNIT I - SIMPLE STRESSES AND STRAINS	**(9+6)**
Stress and Strain due to axial load – Elastic limit – Hooke's law – stress – strain diagram – Stresses in Composite Sections - Poisson's ratio – Shear Stress and Shear Strain – Rigidity Modulus – Volumetric Strain – Bulk Modulus – Relation between elastic constants – Principal Stresses and Strains – Principal Planes.	
UNIT II - ANALYSIS OF PLANE TRUSS	**(9+6)**
Stability and equilibrium of plane frames - types of trusses – analysis of forces in truss members method of joints, method of tension coefficients and method of sections.	
UNIT III - STATICALLY DETERMINATE BEAMS	**(9+6)**
Types of beams and supports –shear force and bending moment diagrams for cantilever, simply supported and over hanging beams – Theory of simple bending – bending stress and shear stress in rectangular, I sections beams	
UNIT IV - DEFLECTION OF BEAMS	**(9+6)**
Slope and Deflection of beams using Double Integration Method, Macaulay's Method, Moment Area Method and Conjugate Beam Method	
UNIT V - TORSION OF CIRCULAR SHAFTS AND SPRINGS	**(9+6)**
Torsion Equation – Assumptions – Theory of Torsion – Stresses in Solid and Hollow Circular Shafts – Power transmitted by the shaft –Types of Springs – Deformations and Stresses in closed and open coiled Helical Springs.	
TOTAL (L: 45 + T:30) = 75 PERIODS	

TEXT BOOKS:

1. Bansal.R.K, "Strength of Materials", Laxmi Publications, New Delhi, 2015.
2. Rajput.R.K "Strength of Materials", S. Chand Publications, New Delhi, 2014.

REFERENCES:

1. Bhavikatti S.S, “Mechanics of Solids”, New Age International, New Delhi, 2010.
2. Egor P Popov, “Engineering Mechanics of Solids”, Prentice Hall of India, New Delhi, 2009
3. Srinath L.S, “Advanced Mechanics of Solids”, Tata McGraw-Hill Publishing Co., New Delhi, 2009.
4. Subramanian.R “Strength of Materials”, Oxford University Press, New Delhi, 2010.

17CEC04 - MECHANICS OF FLUIDS				
L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN: TYPE -4

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand the properties of fluids, fluid statics.	1.1	Understand the basic properties of fluids and their applications	b,d
2.0	To solve kinematic problems such as finding particle paths and stream lines.	2.1	Understand the concepts of static, kinematic and dynamics of fluid flow.	a,b,d
3.0	To study about flow through pipes and pipe networks and boundary layer concepts.	3.1	Learn types of flow and losses of flow in pipes.	a,b,l
4.0	To understand the application of model study.	4.1	Get idea about dimensional and model analysis	b,d
5.0	To analyze and appreciate the complexities involved in solving the fluid flow problems.	5.1	Understand and solve the boundary layer problems	a,b,l

UNIT I - FLUID PROPERTIES AND HYDROSTATICS	(9)
Density – Viscosity – Surface tension – compressibility – capillarity –Measurement of pressure- Hydrostatic forces on plane – inclined and curved surfaces – buoyancy – centre of buoyancy – metacentre.	
UNIT II - FLUID KINEMATICS AND DYNAMICS	**(9)**
Control volume– Fluid Kinematics - Types of flows; Steady flow, Unsteady flow, Uniform and Non Uniform flow, Rotational flow, Irrotational flow, 1-D, 2-D, 3-D flows– Streamline and Velocity potential lines - Euler and Bernoulli"s equations and their applications – moment of momentum – Momentum and Energy correction factorsImpulse – Momentum equation-Navier-Stokes Equations-Applications.	
UNIT III - FLOW THROUGH PIPES	**(9)**
Flow through pipes – Open Channels and Measurement pipe flow: Major and Minor losses – Multi reservoir problems – pipe network design – Moody's diagram – Hagen Poiseuille equation – Turbulent flow. Specific Energy – Critical flow concept – specific force – Hydraulic jump –Pipes in series and in parallel	
UNIT IV- DIMENSIONAL ANALYSIS AND MODEL LAWS	**(9)**
Fundamental dimensions–Dimensional homogeneity – Rayleigh's and Buckingham π theorems – Non-dimensional numbers – Model laws and distorted models.	
UNIT V- BOUNDARY LAYERS AND SEPARATION	**(9)**
Boundary layers – Laminar flow and Turbulent flow – Boundary layer thickness – momentum – Integral equation– Drag and lift-Separation of boundary layer-Methods of separation of boundary layer.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Bansal.R.K. “Fluid Mechanics and Hydraulic Machines”, 9th ed., Laxmi Publications, New Delhi, 2015.
2. Vijay Gupta and Santhosh Kumar Gupta, “Fluid Mechanics and Applications”, 2nd ed., New Age International, Reprint 2012.

REFERENCES:

1. Kumar.D.S, “Fluid Mechanics and Fluid Power Engineering”, S K Kataria and Sons, New Delhi, 2013.
2. Modi.P.N, “Hydraulics and Fluid Mechanics including Hydraulic Machines”, 19th Revised and Enlarged ed., Standard Publishers Distributors, 2013.
3. Victor Streeter, E. Benjamin Wylie and K.W. Bedford, “Fluid Mechanics”, 9th ed., Tata McGraw – Hill Education, New Delhi 2010.

17CEC05 – BUILDING MATERIALS					
		L	T	P	C
		3	0	2	4
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE -3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To have a clear knowledge of building materials and their properties.	**1.1**	Compare the properties of most common and advanced building materials.		**e,l**
2.0	To get idea on joineries and plumbing materials.	**2.1**	Understand the applications of glass, timbers and other materials		**a,b,e**
3.0	To learn the criteria for choice of the appropriate material and	**3.1**	Know the types and application of joineries and plumbing materials		**a,e,l**
4.0	To conduct the various tests for assessing the strength and quality of materials.	**4.1**	Get idea on roofing and flooring materials		**a,e,l**
5.0	To apply the theoretical knowledge to practical problems.	**5.1**	Understand the importance of modern material for construction.		**a,e,l**

UNIT I - BRICKS AND CONCRETE BLOCKS	**(9)**
Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, brick and Concrete hollow blocks – Light weight concrete blocks (AAC).	
UNIT II - GLASS, TIMBER AND OTHER MATERIALS	**(9)**
Glass - Types and its application - Timber – Market forms – Industrial timber– Plywood – Veneer – False ceiling materials – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.	
UNIT III - JOINERIES AND PLUMBING	**(10)**
Doors – Types – Based on materials – Wood, UPVC, Glazed, Fiber reinforced plastic, Steel, Puff, Flush, Aluminium - Based on usage – Pocket, Bi-fold, Sliding, Accordion – Based on manufacturing process - Battened and Ledged Doors, Framed and Panelled Doors, Battened, Ledged and Braced Doors, Flush Doors, Louvered Doors. Windows – Types - Based on materials – Wood, UPVC, Steel, Glass, Aluminium - Based on usage – Fixed, Sliding, Casement, Hopper, Single hung, Awing, Bay, Bow. Plumbing – Types of pipes and its application – Specials – Tee, Elbow, cap, reducer, union, FTA, Y, Nani trap, Q-trap, S-trap, Cowel - Basic plumbing fitting, types and its applications – Water closets, Taps, wash basins, Health Faucet, bib cock, angle valve.	
UNIT IV - FLOORING AND ROOFING MATERIALS	**(8)**
Flooring – Types of Flooring – Materials Used and its source, properties and application – Granite, Marble, Vitrified and ceramic Tile, Kota stone, Mandana – Grano, Epoxy flooring - Roofing Material – Physical descriptions of asbestos sheets, GI sheets, tubes and light weight roofing materials	

UNIT V- MODERN CONSTRUCTION MATERIALS	(9)

Structural Steel and Aluminium –- Modern materials – Neoprene, thermocole, decorative panels and laminates, architectural glass and ceramics, ferrocement, PVC, polymer base materials, fibre reinforced plastics – Grouting materials - Sealants for joints - Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement - colour coated sheets, insulated wall panels

LIST OF EXPERIMENTS:

1. Determination of tension on mild steel rod.
2. Determination of Double shear on mild steel.
3. Finding out Torsional value of mild steel rod.
4. Determination of Compression strength on timber.
5. Determination of Compression strength on bricks,
6. Determination of Izod and Charpy impact test on metal specimens.
7. Finding out the Rockwell Hardness Number on metal Specimens.
8. Finding out the Brinell hardness test on metal Specimens.
9. Finding out the Deflection values on metal beam on various tests.
10. Determination of Elastic properties of open coiled and close coiled helical springs

TOTAL (L: 45 : P:30) = 75 PERIODS

TEXT BOOKS:

1. Varghese.P.C, “Building Materials”, PHI Learning Pvt. Ltd, New Delhi, 2012.
2. Rangwala.S.C, “Engineering Materials”, Charotar Publishing House, New Delhi 2014.
3. Duggal.S.K., "Building Materials", 4th ed., New Age International, 2008

REFERENCES:

1. Rajput.R.K, “Engineering Materials”, S. Chand & Company Ltd., 2011.
2. Gambhir. M.L., and Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
3. Bindra and Arora, “Building Materials and Construction”, Dhanpat Rai & Sons, New Delhi, 1998

17CEC06 – SURVEYING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE -3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	Understand the concepts of different types of surveying and the procedures for carrying out the survey works.	**1.1**	Remember the basics of surveying and different methods of surveying.		**a,b,l**
2.0	To know about contouring works for construction Purposes.	**2.1**	Understand the contouring and leveling concepts		**a,c,d,g**
3.0	To study the different surveying equipment in the field of civil engineering.	**3.1**	Understanding the fundamental function, use of Theodolite and tacheometry in practical applications.		**a,b,e,l**
4.0	To measure the height and distance by Theodolite	**4.1**	Get idea about route surveying		**a,c,d**
5.0	To get introduced to modern surveying equipment's and its techniques	**5.1**	Get exposure on advance surveying such as total Station.		**b,d,e,l**

UNIT I - HISTORY AND TRADITIONAL METHODS OF SURVEYING	**(9)**
Definition - Principles - Classification - Conventional signs - Survey instruments - well conditioned triangles - Traversing - Plane table instruments and accessories - Compass - Types - Bearing - weighted observations - Principle of least squares.	
UNIT II - CONTOUR AND LEVELLING	**(11)**
Level line - Horizontal line - Levels and Staves - Bench marks -Temporary and permanent adjustments - Fly and check Levelling - Reciprocal leveling - Longitudinal and cross sections – Contouring and its characteristics - solve problems by using height of collimation and rise and fall method - Calculation of areas and volumes.	
UNIT III -THEODOLITE SURVEYING	**(9)**
Theodolite - Horizontal angles - Vertical angles - Heights and distances - Tachometric surveying - Tachometric systems - Tangential, stadia - Stadia systems – Horizontal and inclined sights - Vertical and normal staffing - Fixed and movable hairs - Stadia Constants Traversing - Closing error and distribution - Omitted measurements.	
UNIT IV - ROUTE SURVEY AND HYDROGRAPHIC SURVEY	**(7)**
Reconnaissance, Preliminary and location surveys for engineering projects - Hydrographic Surveying - Tides - MSL – Sounding & its methods.	
UNIT V - TOTAL STATION	**(9)**
Introduction- Accuracy of a Total Station- Accessories for Total Station- Functions Performed by Total Stations- Applications of Total Station- Remote Elevation Measurement (REM)- Missing Line Measurement (MLM)- Area Calculation- Setting out	
	TOTAL (L : 45) = 45 PERIODS

TEXT BOOKS:

1.Punmia.B.C. Ashok K. Jain and Arun K. Jain, “Surveying, Vols.I, II and III”, 16th ed.,Laxmi Publications, New Delhi, 2005

2. Duggal R.K, “Surveying”, Vol. I & II, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.

REFERENCES:

1. Kanetkar.T.P “Surveying and Levelling”, Vols. I and II, United Book Corporation, Pune, 1994.

17CEP02 – SURVEYING LABORATORY					
		L	T	P	C
		0	0	4	2
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**	
1.0	To enable the student possess knowledge about Survey field techniques	**1.1**	Compare to practical study on old and advanced methods	**a,d,l**	
2.0	To measure the height and distance by Theodolite	**2.1**	Get knowledge on Compass Surveying methods.	**a,g,l**	
3.0	To familiarize concepts of bearing and included angles using different compass.	**3.1**	Understand the leveling concept	**d,h,l**	
4.0	To provide knowledge on different types of contours	**4.1**	Train to well versed in using theodolite	**a,c,g,l**	
5.0	To get practice on total station	**5.1**	Get exposure to advance surveying such as Total Station.	**b,d,e,l**	

LIST OF EXPERIMENTS:

1. Study of chains and its accessories
2. Compass Traversing
3. Fly leveling using Dumpy level – LS and CS
4. Contouring
5. Stadia Tachometry
6. Tangential Tachometry
7. Measurement of horizontal angles and vertical angles
8. Study on Setting up of Total Station
9. Remote elevation Measurement using Total Station
10. Missing Line Measurement Using Total Station
11. Area measurement using Total Station
12. Study on layout preparation using total station

TOTAL (P:60) = 60 PERIODS

17GED01 - SOFT SKILLS - LISTENING AND SPEAKING					
			L	T	P	C
			0	0	2	0
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To recollect the functional understanding of basic grammar and its structure	**1.1**	Apply the knowledge of basic grammar to classify the types of verbs and questions and to construct the sentences		**i,j,k,l**
2.0	To acquire the listening skills through note completion, matching and multiple choice modes	**2.1**	Develop the listening skills through note completion, matching and multiple choice modes		**i,j,k,l**
3.0	To develop speaking skills through self introduction, short talk and topic discussion	**3.1**	Organize a presentation on the given topic		**i,j,k,l**

UNIT I – GRAMMAR	**(10)**
Tenses - Verb (Auxiliary and Modal) - 'Yes/No' Type Questions - Reported Speech - Gerund - Phrasal Verbs	
UNIT II – LISTENING	**(10)**
Part I : Note completion Part II: Matching Part III: Multiple Choice	
UNIT III – SPEAKING	**(10)**
Part I : Self Introduction Part II: Short talk on business topics Part III: Discussion in pairs	
TOTAL (P:30) : 30 PERIODS	

TEXT BOOKS:

1. Murphy, Raymond, "Essential Grammar in Use", Cambridge University Press, UK, 2007
2. Whitby, Norman ,"Business Benchmark Pre- Intermediate to Intermediate Preliminary, 2nd ed., Cambridge University Press, 2013.

17MYB07 – NUMERICAL METHODS (Common to Civil and Chemical Engg. branches)				
L	T	P	C	
2	2	0	3	
PREREQUISITE : NIL	**QUESTION PATTERN: TYPE -4**			

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program outcomes
1.0	To derive appropriate numerical methods to solve algebraic and transcendental equation.	**1.1**	Solve an algebraic or transcendental equation using an appropriate numerical method	**a,b,d,k,l**
2.0	To find the Lagrange Interpolation Polynomial for any given set of points.	**2.1**	Numerically approximate functions with Lagrange polynomials	**a,e,l**
3.0	To apply several methods of numerical differentiation and integration, including Romberg integration.	**3.1**	Understand and apply appropriate techniques for numerical differentiation and integration.	**a,c,d,l**
4.0	To find numerical solution of a differential equation by Euler's, Modified Euler's, Predictor Corrector and Runge- Kutta Methods.	**4.1**	Make use of numerical methods in the solution of ordinary differential equations which are useful in solving engineering problems	**a,b,e,l**
5.0	To use finite differences for interpolation and differentiation.	**5.1**	Solve initial value problem ordinary differential equations with explicit or implicit methods as appropriate.	**a,b,d,l**

UNIT I - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	**(6+6)**
Solution of equation – Method of criteria for convergence –– Newton Raphson method – Solution of linear system by Gaussian elimination– Iterative methods: Gauss-Seidel method –– Eigen value of a matrix by power method for symmetric matrix.	
UNIT II - INTERPOLATION AND APPROXIMATION	**(6+6)**
Divided differences in unequal intervals –– Lagrangian Polynomials–Newton's forward and backward difference formulas for equal intervals.	
UNITIII - NUMERICAL DIFFERENTIATION AND INTEGRATION	**(6+6)**
Numerical integration by Trapezoidal andSimpson's 1/3 rule – Romberg's method – Two and Three point Gaussian quadrature formulae – Double integrals using trapezoidal and Simpson's rules.	
UNIT IV - INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	**(6+6)**
Single step methods: Taylor series method – Euler's method– Modified Euler method for first order equation – Fourth order Runge –Kutta method for solving first order equations –Multistep methods: Adam's and Milne's predictor and corrector methods.	
UNIT V - BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS	**(6+6)**
Finite difference solution of one dimensional heat equations using Crank-Nicolson, Bender Schmidt methods – Onedimensional wave equation and two dimensional Laplace equations using Liebmann's iteration process.	
TOTAL (L:30+ T:30) : 60 PERIODS	

TEXT BOOKS:

1. T. Veerarajan. and T. Ramachandran., "Numerical Methods with programming in C", 2nd ed., Tata McGraw-Hill, 2006 , First reprint 2007.
2. P. Kandasamy, K.Thilagavathy and K. Gunavathy, "Numerical Methods – Vol: IV", S.Chand& Co. Ltd. New Delhi, 2003, reprint 2007.

REFERENCES:

1. K. SankarRao, "Numerical Methods for Scientists and Engineers", 3rd ed., Prentice Hall of India, New Delhi, 2007,10th reprint 2012.
2. E. Balagurusamy, "Numerical Methods", Tata McGraw-Hill, New Delhi, 1999, 25th reprint 2008.
3. M.K Venkatraman, "Numerical Methods" National Publication, New Delhi, 2000, reprint 2005.
4. B.S.Grewal,"Numerical Methods in Engineering and Science" ,Khanna publishers ,New Delhi,2012.

17CEC07 - MECHANICS OF SOLIDS - II				
L	T	P	C	
3	2	0	4	

PREREQUISITE : 17CEC03	QUESTION PATTERN : TYPE - 4

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To know the method of finding slope and deflection of beams and trusses using energy theorems	1.1	Determine the strain energy and compute the deflection of determinate beams, frames and trusses using energy principles.	a,b,l
2.0	To know the concept of analysing indeterminate beam	2.1	Analyze propped cantilever, fixed beams and continuous beams using theorem of three moment equation.	a,b,d,l
3.0	To understand the concepts of columns and cylinders	3.1	Find the load carrying capacity of columns and stresses induced in columns and cylinders.	a,b,c,l
4.0	To acquire knowledge on the stress in 3D and theories of failure	4.1	Determine principal stresses and planes for an element in three dimensional state of stress and study various theories of failure	a,b,c
5.0	To study of advanced topics in bending of beams	5.1	Determine the stresses due to unsymmetrical bending of beams, locate the shear center, and find the stresses in curved beams.	a,b,d,l

UNIT I - ENERGY PRINCIPLES	(9+6)
Strain energy - Castgliano's theorems - Principle of virtual work - Application of energy theorems for computing deflections in beams and trusses - Maxwell's reciprocal theorems.	
UNIT II - INDETERMINATE BEAMS	**(9+6)**
Propped cantilever and fixed beams - Fixed end moments and reactions for concentrated load (central, non-central), uniformly distributed load -Theorem of three moments - Analyses of continuous beams - Shear force and bending moment diagrams for continuous beams.	
UNIT III - COLUMNS AND CYLINDERS	**(9+6)**
Eccentrically loaded columns middle third rule core section - Euler's theory of elastic columns with different end conditions - Rankine-Gordon formula thin cylinders and shells -Thick cylinders - Compound cylinders.	
UNIT IV - STATE OF STRESS IN THREE DIMENSIONS	**(9+6)**
Determination of principal stresses and principal planes - Volumetric strain - Theories of failure - Mohr's circle of stresses and strains - Application in analysis of stress, load carrying capacity and design of members - Residual stresses.	
UNIT V - UNSYMMETRICAL BENDING AND CURVED BEAMS	**(9+6)**
Symmetrical and unsymmetrical bending - Bending stress in beams subjected to unsymmetrical bending - Curved beams - Stresses due to bending by Winkler Bach theory - Rectangular, trapezoidal, circular solid sections	
TOTAL (L: 45 + T:30) = 75 PERIODS	

TEXT BOOKS:

1. Bansal.R.K, “Strength of Materials”, Laxmi Publications, New Delhi, 2015.
2. Rajput.R.K “Strength of Materials”, S. Chand Publications, New Delhi, 2014.

REFERENCES:

1. S.M.A Kazimi, “Solid Mechanics”, 26th reprint, Tata McGraw Hill Publishing Co., New Delhi, 2006.
2. Egor P Popov, “Engineering Mechanics of Solids”, Prentice Hall of India, New Delhi, 2010
3. PunmiaB.C.”Theory of Structures (SMTS) Vol I &II”, Laxmi Publications Pvt Ltd, New Delhi, 2017.
4. William A .Nash, “Theory and Problems of Strength of Materials”, Schaums Outline Series, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2007.
5. D. S. Bedi, “Strength of Materials”, S. Chand & Co. Ltd., 2012

17CEC08 - SOIL MECHANICS					
		L	T	P	C
		3	0	2	4
PREREQUISITE : 17CEC02		**QUESTION PATTERN : TYPE - 4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart the fundamental concepts of soil mechanics	**1.1**	Classify the soil and assess the engineering properties, based on index properties.	**a,b,d,g,l**
2.0	To understand the role of water in soil behavior and how soil stresses, permeability and quantity of seepage estimated.	**2.1**	Estimate soil stresses and prepare flow net diagram.	**a,b,d**
3.0	To understand the soil stress distribution and stress influence under various loading conditions.	**3.1**	Do proper stress estimation for various types of foundation loads.	**a,b,c,d**
4.0	To estimate the total settlement and time rate of settlement of the soil.	**4.1**	Understand and identify the settlement in soils.	**b,g,l**
5.0	To familiarize about the fundamental concepts in shear strength of soils	**5.1**	Analyze shear properties of cohesive and cohesionless soils	**a,b,l**

UNIT I - WEIGHT VOLUME RELATIONS AND INDEX PROPERTIES	**(9)**
Soil formation -Three phase diagram - Weight-volume relations - Index properties of soils - Atterberg's limits - Classification of soils - BIS System.	
UNIT II - SOIL WATER AND PERMEABILITY	**(9)**
Soil water - Effective and neutral stresses - Flow of water through soils – Permeability - Laboratory methods - Darcy's law - Seepage and flow-nets - Quick sand.	
UNIT III - STRESS DISTRIBUTION IN SOILS	**(9)**
Vertical pressure distribution -Boussinesq's equation for point load and uniformly distributed loads - New mark's influence chart - Westergaard's equation -Isobar diagram - Pressure bulb - Contact pressure distribution.	
UNIT IV - CONSOLIDATION AND COMPACTION	**(9)**
Compressibility - e-log p curve - Preconsolidation pressure - Primary consolidation - Terzaghi's consolidation theory - Compaction - factors affecting soil compaction - Laboratory compaction tests - dry density and moisture content relationship - field compaction.	
UNIT V - SHEAR STRENGTH OF SOIL	**(9)**
Shear strength of soils - Stress analysis by Mohr's circle - Mohr's strength theory - Mohr-Coloumb strength envelope - Measurement of shear strength - Direct shear test - Triaxial compression - Unconfined compression test - Vane shear test - Shear strength of saturated cohesive soils - Shear strength of cohesionless soils.	

LIST OF EXPERIMENTS:

1. Determination of Moisture Content
2. Determination of Specific Gravity of soil
3. Sieve Analysis for Coarse Grained soil
4. Atterberg's Limits
5. Sand replacement Test

6. Field Density Test
    a. Core Cutter Method
    b. Standard Proctor's Compaction Test
7. Permeability Test

TOTAL (L: 45+ P:30) = 75 PERIODS

TEXT BOOKS:

1. Arora K.R"Soil Mechanics and Foundation Engineering ", Standard Publishers and Distributors, New Delhi, 2005.
2. Gopal Ranjan and Rao A.S.R." Basic and Applied Soil Mechanics", Wiley Eastern Ltd, New Delhi, 2007.
3. Punmia P.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2005.

REFERENCES:

1. Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd ed., Pearson Education, 2013
2. Khan I.H., "A text book of Geotechnical Engineering ", Prentice Hall of India, New Delhi, 2012.
3. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2007 (Reprint).

17CEC09 - HIGHWAY ENGINEERING				
L	T	P	C	
3	0	0	3	

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE -3**

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program outcomes
1.0	To understand the importance of transportation, highway planning, alignment and surveys.	**1.1**	Carry out surveys involved in planning and highway alignment.	**a,c,l**
2.0	To know geometric design of highways.	**2.1**	Design various geometric elements of highways.	**b,l**
3.0	To know about the highway materials and its construction.	**3.1**	Analyse the various characteristics of highway materials and test this quality	**c,d**
4.0	To design Rigid and Flexible pavements.	**4.1**	Design of flexible and rigid pavement as per IRC codes.	**a,b,g,l**
5.0	To understand highway construction, distresses in pavements and maintenance options.	**5.1**	Analyse the concepts of pavement failures and apply it in maintenance methods	**b,d,g,l**

UNIT I - HIGHWAY PLANNING AND ALIGNMENT **(9)**

Introduction to Transportation modes - Highway classification - Highway alignment and Engineering surveys for Alignment- conventional and modern methods - Master Plan - Traffic Studies - origin and destination studies.

UNIT II - GEOMETRIC DESIGN OF HIGHWAY **(10)**

Road Geometrics - Highway cross section elements - Camber - Sight Distance - Horizontal Alignment Design, Super Elevation, Extra widening, Transition curves - Design of Vertical curves.

UNIT III - HIGHWAY MATERIALS AND CONSTRUCTION **(9)**

Material requirement for pavements - Soil classification for Highway - Soil tests , CBR and Plate Load Test - Aggregate, materials testing and specifications - Bitumen, material testing and specification - Construction of Flexible and Rigid pavement.

UNIT IV - HIGHWAY DESIGN **(8)**

Pavement Analysis - Factors affecting pavement thickness - Soil - Wheel load - Temperature - Environmental factors; Flexible Pavement Design - Axle Load surveys - CBR method of Design, Rigid Pavement Design - IRC method.

UNIT V - HIGHWAY MAINTENANCE AND DRAINAGE **(9)**

Pavement Failures and Causes of Pavement failures - Pavement Management Systems - Pavement evaluation - Strengthening of pavements -Types of maintenance - Highway Drainage - Importance of highway drainage - special considerations for hill roads.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. S.K.Khanna, C.E.G.Justo, "Highway Engineering", New Chand & Bros, Roorkee, 2015.
2. L.R.Kadiyali and N.B Lal, "Principles and Practice of Highway Engineering (Including expressways and Airport Engineering)", Khanna Publishers, New Delhi, 2013.

REFERENCES:

1. G.V Rao, "Principles of Transportation and Highway Engineering", Tata McGraw Hill Co, New Delhi, 2005.
2. ParthaChakroborthy, Animesh Das, "Principles of Transportation Engineering", Prentice-Hall of India, New Delhi, 2011.

17CEC10 - APPLIED HYDRAULICS ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17CEC04		**QUESTION PATTERN : TYPE -3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To relate the theory and practice of problems in hydraulic engineering.	**1.1**	Apply their knowledge of fluid mechanics in addressing problems in open channels.	**a,b,l**
2.0	To introduce various hydraulic engineering problems like open channel flows and flow characteristics	**2.1**	Able to identify a effective section for flow in different cross sections	**b,k**
3.0	To understand the concept of hydraulic jumps and surges.	**3.1**	Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.	**a,b,c,l**
4.0	To understand the concepts and performance characteristics of flow through turbines.	**4.1**	Understand the principles, working and application of turbines	**a,e,g,l**
5.0	To study the classification, performance characteristics and design aspects of pumps.	**5.1**	Understand the principles, working and application of pumps.	**a,e,l**

UNIT I - UNIFORM FLOW	**(9)**
Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force – Critical flow .	
UNIT II - GRADUALLY VARIED FLOW	**(9)**
Dynamic equations of gradually varied flows – Types of flow profiles - Classifications: Computation by Direct step method and Standard step method – Control section – Break in Grade – Computation	
UNIT III - RAPIDLY VARIED FLOW	**(9)**
Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Celerity – Rapidly varied unsteady flows (positive and negative surges)	
UNIT IV – TURBINES	**(9)**
Impact of Jet on flat, curved plates, Stationary and Moving –Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine - Specific speed – Characteristic Curves of Turbines- Draft tube and cavitation.	
UNIT V – PUMPS	**(9)**
Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump - NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip - Indicator diagrams and its variations – Air vessels - Savings in work done.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Bansal.R.K "Fluid Mechanics and Hydraulic Machines", 9th revised ed., Laxmi Publications, New Delhi, Reprint 2015.
2. Subramanya.K ,"Flow in open channels", Tata McGraw Hill, New Delhi, 2000.
3. Subramanya.K., " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.

REFERENCES:

1. V.T.Chow, “Open Channel Hydraulics”, Blackburn Press, Caldwell United States, 2009.
2. Modi P.N and Seth.S.M "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
3. Jain.A.K., " Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, 12th ed., 2016

17CEC11 - CONCRETE TECHNOLOGY [IS: 10262: 2009 and IS 456:2000 Code Books are to be permitted]				
L	T	P	C	
3	0	0	3	
PREREQUISITE : 17CEC05	**QUESTION PATTERN : TYPE -3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart knowledge on the types and properties of cement.	**1.1**	Determine the properties of cement.	**b,c,d,g,j,l**
2.0	To understand about properties of concrete making materials.	**2.1**	Find out the properties of aggregates and admixtures	**b,d,e,l**
3.0	To study about concrete design mix.	**3.1**	Understand the IS mix design and quality control of concrete	**a,b,c,d,e, f,j,l**
4.0	To study the behaviour of concrete at the fresh and hardened state.	**4.1**	Determine the properties of fresh and hardened concrete.	**b,e, f,j,l**
5.0	To impart knowledge on the special concretes	**5.1**	Acquire knowledge about the application of special concretes	**c,d,e,f, j,l**

UNIT I - PROPERTIES OF CEMENT	**(9)**
Manufacturing of Cement by wet and dry Process, Types of cement – Properties of Cement - Heat of Hydration - Test on Cement - Field Test - Laboratory Testing Methods - Fineness of cement, Consistency of cement, Specific Gravity of cement, Setting properties of cement, Soundness of cement and compressive strength of cement mortar.	
UNIT II - AGGREGATES AND ADMIXTURES	**(9)**
Fine aggregate and coarse aggregate - Properties and testing methods of fine aggregates - fineness modulus - Bulking of Sand - sieve analysis - Properties and testing methods of coarse aggregates - Crushing test, Abrasion test, Impact test, Specific gravity and water absorption test - mineral and chemical admixtures.	
UNIT III - MIX DESIGN AND CONCRETE PRODUCTION	**(9)**
Selection of materials for concrete - water cement ratio - Concrete mix design – concepts variables in proportioning – methods of mix design - Indian Standard method, Factor affecting the test results, process of manufacture of concrete- Properties of fresh concrete - workability – measurement of workability - Statistical and quality control of concrete.	
UNIT IV - STRENGTH OF CONCRETE	**(9)**
Strength of concrete - gain of strength with age – testing of hardened concrete - Compressive strength - Tensile strength - Flexural strength - modulus of elasticity of concrete- Stress and Strain characteristics. Introduction to NDT Techniques- Rebound hammer and Ultrasonic pulse velocity test.	
UNIT V - SPECIAL CONCRETES	**(9)**
Introduction to Polymer concrete, High performance concrete, High strength concrete, Fibre reinforced concrete, Light weight concrete, Ready mix concrete and pumping of concrete.	
TOTA(L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Santhakumar.A. R “Concrete Technology”, Oxford University Press, New Delhi, 2006.
2. Shetty M.S. “Concrete Technology”, S. Chand & Company Ltd, New Delhi, 2010

REFERENCES:

1. Metha P.K, “Concrete: Microstructure, properties and Materials”, McGraw-Hill, New Delhi 2005.
2. Neville.N.M, “Properties of Concrete”, 5th ed., Prentice-Hall of India, New Delhi, 2012.
3. IS : 12269-1987,“Specification for 53 grade OPC”, BIS, New Delhi
4. IS : 383 - 2016, Coarse and Fine Aggregate - Specification, BIS, New Delhi
5. IS: 10262: 2009 “Concrete mix proportioning - Guidelines, BIS, New Delhi.
6. IS: 456-2000, “Plain and Reinforced Concrete - Code of Practice, BIS, New Delhi.

17CEP03 - BUILDING DRAWING – II					
		L	T	P	C
		0	0	4	2
PREREQUISITE : 17CEP01					

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To enable students to possess knowledge about the building components.	**1.1**	Familiarize with the standard symbols and sign conventions suitably	**g,l**
2.0	To understand the sketches and working drawings	**2.1**	Know about the different type of structures	**e,i,l**
3.0	To enable the students to create plan, section and elevation of buildings using software package	**3.1**	Draw the elevation and sectional views of the buildings using computer software.	**a,c,d,e,h,l**
4.0	To understand the regulations as per National Building Code	**4.1**	Implement the regulations for layout planning and preparation of drawings	**b,c,d,e,l**
5.0	To Understand the concept of 2D & 3D	**5.1**	Understand the different views of the components of a building.	**c,d,e,l**

LIST OF EXPERIMENTS:

1. Detailed working drawing for Residential Building – Site Plan, Foundation Plan, Floor Plans, Cross Section, Elevation, Staircase plan.
2. Plan, Section and Elevation of load bearing structure (Flat roof& Sloped roof)
3. Plan, Section and Elevation of RCC framed structures (Two storey)
4. Plan, Section and Elevation of Industrial buildings – Workshop (Steel roof structures)
5. Perspective view of Residential buildings
6. Requirements of Drawings as per National Building Code

TOTAL (P: 60) = 60 PERIODS

REFERENCES / MANUALS / SOFTWARES:

1. Computer Aided Design and Drafting software.
2. Varma B.P, "Civil Engineering Drawing & House Planning", Khanna Publishers, New Delhi, 2014.
3. NBC, local town planning authority rules and regulations
4. George Omura, Brian C. Benton, "Mastering AutoCAD 2014 and AutoCAD LT2014", Wiley – An Autodesk Official Press, 2013.
5. Kumaraswamy N., Kameswara Rao A., "Building Planning and Drawing", Charotar Publishing, 2013.

17CEP04 - HYDRAULICS ENGINEERING LABORATORY				
	L	T	P	C
	0	0	4	2

PREREQUISITE : 17CEC04

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To verify the principles studied in theory by performing the experiments in lab.	**1.1**	Measure flow in pipes and determine frictional losses	**a,b,l**
2.0	To impart the knowledge about practical applications concept of Hydraulic Engineering Laboratory.	**2.1**	Demonstrate characteristics curves of pumps and turbines.	**b,l**
3.0	To familiarize the determination of major and minor losses in pipes	**3.1**	Estimate the Co-efficient of discharge for orifice and notches	**a,b,e**
4.0	To acquire knowledge on finding the efficiency of various types of pumps	**4.1**	Measure discharge in pipes.	**a,b,d,e,l**
5.0	To provide knowledge on various types of turbines and their applications	**5.1**	Determine the energy loss in pipe flow.	**a,b,c,d**

LIST OF EXPERIMENTS:

Flow Measurements

1. Calibration of Rotameter
2. Calibration of Venturimeter / Orificemeter
3. Bernoulli's Experiment

B.Losses in Pipes

4.Determination of friction factor in pipes
5. Determination of minor losses

C.Pumps

6.Characteristics of Centrifugal pumps
7. Characteristics of Gear pump
8. Characteristics of Submersible pump
9. Characteristics of Reciprocating pump

D.Turbines

10.Characteristics of Pelton wheel turbine
11. Characteristics of Francis turbine/Kaplan turbine

E.Determination of Metacentric height

12.Determination of Metacentric height of floating bodies

TOTAL (P: 60) = 60 PERIODS

REFERENCES:

1. Sarbjit Singh."Experiments in Fluid Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2009.
2. "Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.
3. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2000.
4. Subramanya K. "Flow in Open Channels", Tata McGraw Hill Publishing Company, 2001.

17GED02 - SOFT SKILLS – READING AND WRITING				
	L	T	P	C
	0	0	2	0

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program outcomes
1.0	To recollect the functional understanding of parts of speech and basic grammar	**1.1**	Apply the knowledge to identify the parts of speech and construct the sentences	**i,j,k,l**
2.0	To acquire the reading skills through cloze texts, matching and multiple choice modes	**2.1**	Develop the reading skills through cloze texts, matching and multiple choice modes	**i,j,k,l**
3.0	To enhance the writing skills for a variety of purposes	**3.1**	Interpret effectively through writing for a variety of purposes	**i,j,k,l**

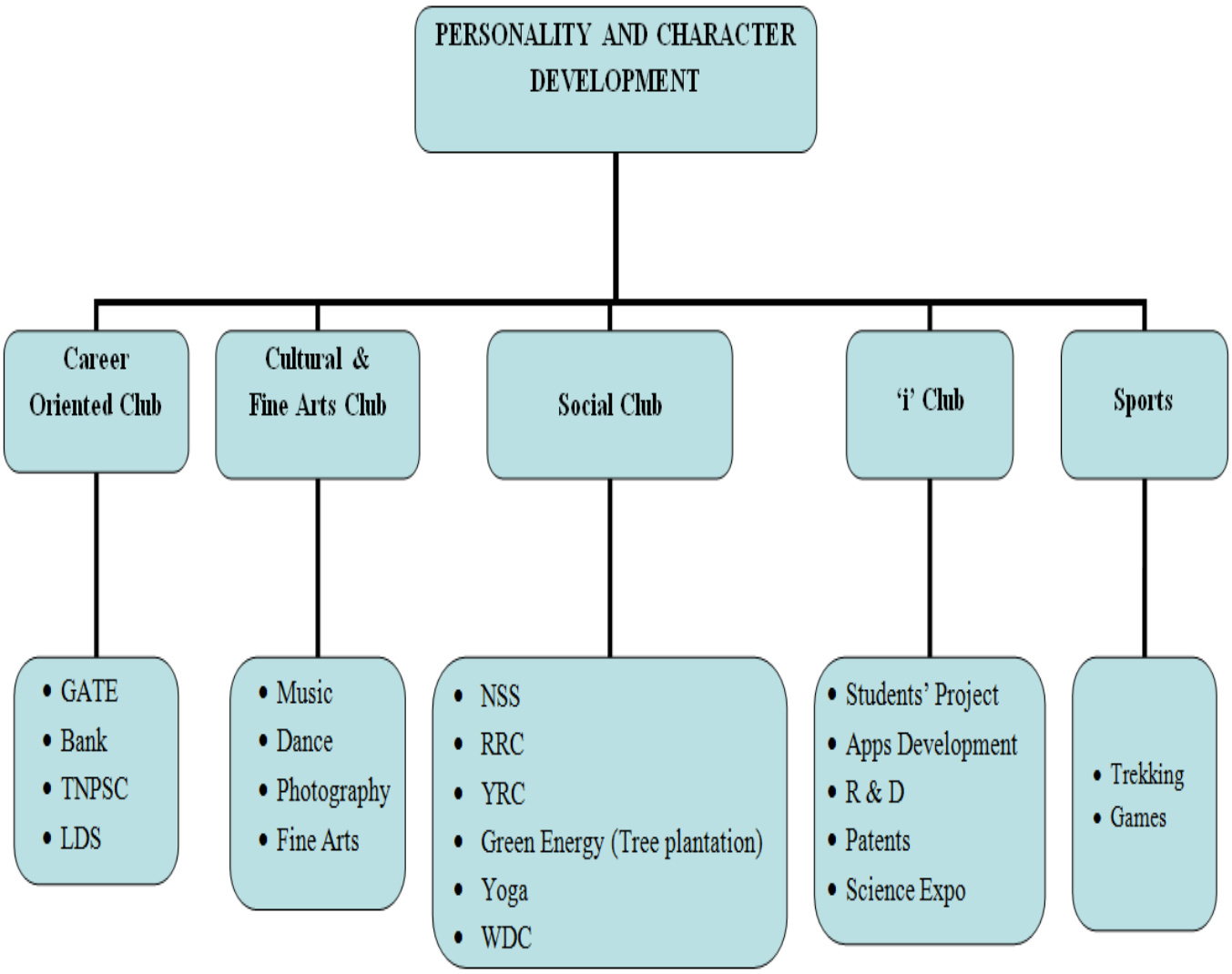
UNIT I - GRAMMAR	**(10)**
Articles - Adjectives - Conjunctions - Prepositions - Idioms and Phrases	
UNIT II – READING	**(10)**
Part I : Matching 7 sentences to four short texts Part II: Text with sentences missing Part III: Text with multiple choice questions Part IV: Text with multiple choice gaps Part V: Identification of additional unnecessary words in text	
UNIT III -WRITING	**(10)**
Part I : E-mail writing, Writing short notes, Memo, Agenda & Minutes Part II: Report Writing, Complaint Letter, Writing Proposals	
TOTAL (P:30) : 30 PERIODS	

REFERENCES:

1. Murphy, Raymond, "Essential Grammar in Use", Cambridge University Press, UK, 2007.
2. Whitby, Norman, "Business Benchmark Pre - Intermediate to Intermediate Preliminary", 2nd ed., Cambridge University Press, 2013

17GED03 - PERSONALITY A ND CHARACTER DEVELOPMENT

L	T	P	C
0	0	1	0



***LDS - Leadership Development Skills**

OBJECTIVES :				
Career Oriented Club	**Cultural & Fine Arts Club**	**Social Club**	**'i' club**	**Sports**
•To provide support for identifying specific career field of interests and career path •To provide support for preparing for competitive exams	•To bring out the hidden talent of students in music, dance and other fine arts. •To promote photography skill among the students •To develop and enhance the performance of students by participating in various events •To inculcate managerial capabilities such as event management and stage organization	•To create social awareness and develop a sense of social and civic responsibility •To inculcate socially and environmentally sound practices and be aware of the benefits •To encourage the students to work along with the people in rural areas, thereby developing their character, social consciousness, commitment, discipline and being helpful towards the community.	•To inculcate the basic concepts of innovation •To foster the networking between students, build teams, exchange ideas, do projects and discuss entrepreneurial opportunities •To enrich the academic experience, build competencies and relationships beyond the classroom	•To provide opportunities to excel at sports •To promote an understanding of physical and mental well-being through an appreciation of stress, rest and relaxation. •To develop an ability to observe, analyze and judge the performance of self and peers in sporting activities. •To develop leadership skills and nurture the team building qualities. **<u>Trekking:</u>** •To provide opportunities to explore nature and educating about the purity of nature •To improve physical and mental health.

OUTCOMES : At the end of this course, the students will be able to				
•Find a better career of their interest. •Make use of their knowledge during competitive exams and interviews.	•Take part in various events •Develop team spirit, leadership and managerial qualities	•Develop socially responsive qualities by applying acquired knowledge •Build character, social consciousness, commitment and discipline	•Apply the acquired knowledge in creating better solutions that meet new requirements and market needs •Develop skills on transforming new knowledge or new technology into viable products and services on commercial markets as a team	•Demonstrate positive leadership skills that contribute to the organizational effectiveness •Take part an active role in their personal wellness (emotional, physical, and spiritual) that supports a healthy lifestyle •Create inclination towards outdoor activity like nature study and Adventure.

TOTAL [2 x (P: 15)]: 30 PERIODS

(Cumulatively for Two Semesters)

17CEC12 - STRUCTURAL ANALYSIS – I					
		L	T	P	C
		3	2	0	4
PREREQUISITE : 17CEC07		**QUESTION PATTERN : TYPE – 4**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To introduce the basic concepts of structural analysis and the classical methods for the analysis of buildings.	**1.1**	Analyze continuous beams, pin-jointed indeterminate plane frames and rigid plane frames		**a,b,c**
2.0	To analyse the structures for internal forces by theorem of three moments and slope deflection method.	**2.1**	Analyse the continuous beams and portal frames by slope defection method.		**a,b,c**
3.0	To analyse the structures for internal forces by Moment distribution method.	**3.1**	Understand the concept of moment distribution method.		**a,b**
4.0	To analyse the indeterminate structures and settlement of supports	**4.1**	Analyse the beams and support by kani's method.		**a,b**
5.0	To understand an influence lines for statically determinate and indeterminate beams.	**5.1**	Draw the influence lines for statically determinate and indeterminate structures		**b,c**

UNIT I - PIN JOINTED FRAME	**(9+6)**
Degree of static and kinematic indeterminacies of plane frames - analysis of indeterminate pin-jointed frames - rigid frames (Degree of statically indeterminacy upto two). Principles of virtual work for deflections - Deflections of pin jointed plane frames and rigid frames.	
UNIT II - SLOPE DEFLECTION METHOD	**(9+6)**
Slope deflection method - analysis of continuous beams and portal frames (with and without sway) - bending moment and shear force diagram.	
UNIT III - MOMENT DISTRIBUTION METHOD	**(9+6)**
Moment distribution method - analysis of continuous beams and portal frames (with and without sway) - bending moment and shear force diagram.	
UNIT IV - ENERGY METHOD	**(9+6)**
Kani's Method - Analysis of Indeterminate Structures - Settlement of Supports (with and without sway)	
UNIT V - INFLUENCE LINES	**(9+6)**
Influence line - influence lines for bending moment and shear force, Muller Breslau's - principle, determinate and indeterminate beams.	
	TOTAL (L: 45+ T:30) = 75 PERIODS

TEXT BOOKS:

1. Vaidyanathan, R and Perumal, P., "Comprehensive Structural Analysis," Volume I and II, Laxmi Publications Pvt. Ltd., Chennai, 4th ed., 2016.
2. Subrata Chakarabarty, Sujit Kumar Roy., "Fundamentals of Structural Analysis", S.Chand & Company Ltd, New Delhi, 2012.

REFERENCES:

1. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain., "Theory of Structures", Laxmi Publications, New Delhi, 2015.
2. S.S.Bhavikatti, "Structural Analysis" – Vol.I& II, Vikas Publishing Pvt Ltd., New Delhi, 4th ed.,2013.
3. Wang, C.K., "Analysis of Indeterminate Structures", Tata McGraw-Hill, New Delhi, 2000.
4. Negi, L.S. and Jangid, R.S., "Structural Analysis", Tata McGraw-Hill Publications, New Delhi, 2004.

17CEC13 - DESIGN OF REINFORCED CONCRETE ELEMENTS (IS 456 : 2000 and SP 16 code books are to be permitted)					
		L	**T**	**P**	**C**
		3	**2**	**0**	**4**
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE- 4**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To understand the concept of working stress and limit state methods.	**1.1**	Identify the basic concepts and methods in the design of reinforced concrete elements.		**b,l**
2.0	To gain knowledge of limit state design of beam	**2.1**	Design the beam using IS code of practice.		**a,b,l**
3.0	To understand the design concepts in slab and staircase	**3.1**	Apply the concepts in design of slab and staircase.		**a,b,l**
4.0	To understand the concepts in the design of RC Column.	**4.1**	Design of RC columns of any cross section with different end conditions.		**a,b,l**
5.0	To give the knowledge in the concept of RC footings.	**5.1**	Select and design of RC footing of different cross section under various site conditions.		**a,b,h,l**

UNIT I DESIGN PHILOSOPHY	**(6+6)**
Concept of Elastic method, ultimate load method and limit state method - Advantages of Limit State Method over other methods - Design codes and specification - Limit State philosophy as detailed in IS code.	
UNIT II DESIGN OF BEAM	**(12+6)**
Analysis and design of singly and doubly reinforced rectangular beam and Flanged beams (T- Beams only) - Use of design aids for Flexure - Behaviour of RC members in Shear, Bond and Anchorage - Design requirements as per current code - Behaviour of rectangular RC beams in shear and torsion - Design of RC members for combined Bending, Shear and Torsion.	
UNIT III DESIGN OF SLAB AND STAIRCASE	**(9+6)**
Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams -Two way slab - Design of simply supported and continuous slabs using IS code coefficients - Types of Staircases - Design of dog-legged Staircase.	
UNIT IV DESIGN OF COLUMN	**(9+6)**
Types of columns – Braced and unbraced columns - Design of short rectangular and circular columns for axial, uniaxial and biaxial bending.	
UNIT V DESIGN OF FOOTING	**(9+6)**
Design of wall footing - Design of axially and eccentrically loaded rectangular pad and sloped footings - Design of combined rectangular footing for two columns only.	
TOTAL (L: 45+ T:30) = 75 PERIODS	

TEXT BOOKS:

1. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2007.
2. Varghese.P.C., “Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
3. N. Krishna Raju, “Design of Reinforced Concrete Structures (IS: 456-2000)”, 4rd ed., 2016.

REFERENCES:

1. Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2014
2. UnnikrishnaPillai, S., DevdasMenon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., 3rd ed.,2009
3. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
4. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
5. SP:16, “Design Aids for Reinforced Concrete”, Bureau of Indian Standards, New Delhi, 2007

17CEC14 - FOUNDATION ENGINEERING (IS 6403 code book is to be permitted)					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17CEC08		**QUESTION PATTERN : TYPE- 4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart knowledge for plan and execute a detail site investigation programme	**1.1**	Understand the importance of soil investigation in various civil Engineering projects	**b,e**
2.0	To explain the concepts related to bearing capacity and settlement for various types of soils and loading conditions.	**2.1**	Estimate bearing capacity incorporating IS codal provisions.	**a,b,l**
3.0	To select geotechnical design parameters and type of foundations	**3.1**	Do proper foundation proportioning for any kind of shallow foundation system and get exposure in foundation analysis.	**a,d,j,l**
4.0	To discuss different types of pile foundation and its capacity	**4.1**	Estimate pile and pile group capacity, group efficiency for various types of soils	**a,b,c,e,g,l**
5.0	To study various earth pressure theories	**5.1**	Analysis earth retaining structures for various soil conditions	**a,g,l**

UNIT I - SOIL INVESTIGATION AND CHOICE OF FOUNDATION	**(7)**
Methods of Soil Exploration - Boring - Sampling - Disturbed and undisturbed Sampling - Sampling techniques - Bore log and soil investigation report - Function and requirements of good foundation - Choice of foundation based on soil conditions.	
UNIT II - BEARING CAPACITY AND SETTLEMENT	**(9)**
Location and depth of foundations - Bearing capacity of shallow foundations on homogeneous deposit -Terzaghi's Theory - IS Code method - Problems - Field tests (SPT and SCPT) - Factors influencing Bearing Capacity - Settlement of foundations - Components of settlement - Allowable and maximum differential settlement.	
UNIT III - SHALLOW FOUNDATION	**(9)**
Types of footings - Contact pressure distribution: isolated footing - combined footings - proportioning - Mat foundation – Types and applications - Floating foundation.	
UNIT IV - PILE FOUNDATION	**(9)**
Need for deep foundations -Types of piles - classification of piles – Load carrying capacity of piles in granular and cohesive soils - Static and Dynamic formulae - Pile carrying capacity by field tests - Pile load test - Group Capacity - Settlement of Pile groups - Negative skin friction.	
UNIT V - STABILITY OF SLOPES AND EARTH PRESSURE	**(11)**
Slopes – Infinite and finite slopes - types of failure - causes of failure - Procedure for slip circle method - Earth pressure in soils: active and passive states - Lateral earth pressure - Rankine's theory - Cullman‟s Graphical method - Stabilization of soil using various methods.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Dr. K. R. Arora., "Soil Mechanics and Foundation Engineering", Standard Publisher, New Delhi, 7th ed., 2017.
2. Venkataramaiah.C, "Geotechnical Engineering", New Age International Ltd., New Delhi, 2008.

REFERENCES:

1. Varghese P.C., “Foundation Engineering”, Prentice Hall of India, 2012.
2. Alam Singh., “Modern Geotechnical Engineering”, IBS Publications, New Delhi, 2012.
3. Punmia. B. C., “Soil Mechanics and Foundation Engineering”, Laxmi Publications, New Delhi, 16th ed., 2005.
4. Gopal Ranjan and Rao, “Basic and Applied Soil Mechanics”, New Age International Pvt Ltd, New Delhi, 2002
5. IS 6403 - 1981, “Code of Practice for Determination of Bearing Capacity of Shallow Foundation”, Bureau of Indian Standards, New Delhi.

17CEC15 - WATER RESOURCES AND IRRIGATION ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes (The students will be able to)		Related Program outcomes
1.0	To emphasize the need for water resources planning	**1.1**	Get exposure about the developments of water resources.	**g,k**
2.0	To emphasis the need and importance of Irrigation	**2.1**	Assess the irrigation needs of crops	**c,e,g,i**
3.0	To impart required knowledge on hydraulic design of different structures and the concept of maintenance	**3.1**	Study about different types of structures for irrigation	**c,e,l**
4.0	To provide training on design of impounding structures	**4.1**	Implement various types of irrigation methods	**c,d,g**
5.0	To realize the importance of participatory irrigation management	**5.1**	Plan for water management and minimize irrigation water losses	**g,k**

UNIT I - INTRODUCTION OF WATER RESOURCES	**(9)**
Water resources survey – Description of water resources planning - Estimation of water requirements for irrigation and drinking - Single and multipurpose reservoir. Flood - levees and flood walls. Concept of basin as a unit for development - Water budget - Conjunctive use of surface and ground water.	
UNIT II - INTRODUCTION OF IRRIGATION ENGINEERING	**(9)**
Irrigation - Need and mode of irrigation - Merits and demerits of irrigation - Crop and crop seasons –consumptive use of water - Duty - Factors affecting duty - Irrigation efficiencies - Planning and Development of irrigation projects.	
UNIT III - CANAL IRRIGATION	**(9)**
Gravity dam - Diversion Head works - Alignment of canals - Classification of canals - Canal drops - Cross drainage works - Canal Head works - Canal regulators - River Training works.	
UNIT IV - IRRIGATION METHODS	**(9)**
Lift irrigation - Canal irrigation - Tank irrigation - Flooding methods - Sprinkler irrigation - Drip irrigation. Well irrigation - Irrigation methods: Surface and Sub-Surface and Micro Irrigation - Merits and demerits	
UNIT V - IRRIGATION WATER MANAGEMENT	**(9)**
Need for optimization of water use – Minimising irrigation water losses – On farm development works -Participatory irrigation management – Water users associations	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009
2. Punmia B.C. and Pande B.B .Lal Irrigation and Water Power Engineering, Laxmi Publishing, New Delhi, 2007
3. Michael, A.M, Irrigation Theory and Practical, Vikas Publishing Pvt Ltd, 2006
4. Gupta, B.L, and Amir Gupta, "Irrigation Engineering", Satya Praheshan, New Delhi, 2007

REFERENCES:

1. Dilip Kumar Majumdar, "Irrigation Water Management (Principles and Practices)", Prentice Hall of India (P), Ltd, 2000
2. Basak, N.N, "Irrigation Engineering", Tata McGraw-Hill Publishing Co. New Delhi, 1999
3. Sharma R.K. "Irrigation Engineering", S.Chand and Co. 2007.

17CEP05 - CONCRETE AND HIGHWAY ENGINEERING LABORATORY				
L	T	P	C	
0	0	4	2	

PREREQUISITE : 17CEC11

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To provide an opportunity to learn how to measure the parameters which governs the quality of the materials	**1.1**	Evaluate the various properties of cement and concrete.	**b,j,l**
2.0	To learn the tests on hardened concrete and how the different materials shall modify the performance of concrete.	**2.1**	Diagnose the properties of aggregates with different testing methods	**b,j,l**
3.0	To find the properties of constituent materials and fresh concrete	**3.1**	Ensure the strength characteristics of the given concrete	**a,b.k,l**
4.0	To study the various tests carried out on aggregates	**4.1**	Prepare different concrete mixes and check the workability properties	**a,b,l**
5.0	To learn the principles and procedures of testing of highway materials	**5.1**	Gain sufficient idea on practice and procedure of using bitumen in road works	**b,l**

LIST OF EXPERIMENTS:

1. **TEST ON CEMENT**
   a. Fineness Test
   b. Consistency Test
   c. Initial and Final Setting Time Test
   d. Soundness Test

2. **TEST ON FINE AGGREGATE**
   a. Specific Gravity
   b. Fineness Modulus

3. **TEST ON COARSE AGGREGATE**
   a. Specific Gravity
   b. Water Absorption Test
   c. Impact Strength Test
   d. Crushing Strength Test
   e. Abrasion and Attrition Test

4. **TEST ON FRESH CONCRETE**
   a. Slump Test
   b. Vee-Bee Test
   c. Compaction Factor Test
   d. Flow table

5. **TEST ON HARDENED CONCRETE**
   a. Test on Cubes (Compressive Strength Test)
   b. Test on Cylinders (Split Tensile Strength)
   c. Test on Prisms (Flexural Strength of Concrete)

6. **NON -DESTRUCTIVE TESTS**
   a. Rebound Hammer Test
   b. Ultrasonic Pulse Velocity Test

7. **TESTS ON BITUMEN**
   a. Penetration test
   b. Ductility test
   c.Marshal Stability and Flow Values (Study Experiment)

TOTAL (P: 60) = 60 PERIODS

REFERNCES:

1. Shetty. M. S, "Concrete Technology", Published by S. Chand & Co., Ltd, New Delhi, 2010.
2. IS: 10262 - 2009, Indian Standard specification for Methods of Mix design.
3. IS: 383 - 1987, Indian Standard specification for Test for Fine and Coarse aggregates from natural source for concrete.
4. IS: 1203 to 1208 - 1978, Indian Standard specification for Bitumen test

17CEP06 – EMPLOYABILITY SKILLS - I				
L	T	P	C	
0	0	2	0	

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To instruct and improve the design capability of the student.	**1.1**	Gain sufficient idea on practice of preparing plan in Civil Engineering.	**a,b,e, g,l**
2.0	To prepare a plan of RCC Structure complete set of drawings	**2.1**	Develop the plan into 2D and 3D view of Buildings	**a,b,l**
3.0	To learn about measurement	**3.1**	Get idea on measurement	**a,b,c,d,e,l**
4.0	To understand about the plan, section and elevation	**4.1**	Get more knowledge about the drawing using software	**a,b,d,l**

LIST OF EXPERIMENTS:

To measure the data from site (Building more than (G +1) and Industrial building with roof truss), from that data is to Prepare (Plan, Section and Elevation) the following

1. Manual Drawing
2. Computer Aided Drawing (2D and 3D)

The method of evaluation will be as follows:

1. Evaluation of Report : 80 marks
2. Viva voce examination : 20 marks

TOTAL: 100 MARKS

TOTAL (P: 30) = 30 PERIODS

17GED07- CONSTITUTION OF INDIA					
			L	T	P	C
			2	0	0	0
PREREQUISITE : NIL					
COURSE OBJECTIVES ANDOUTCOMES:					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**	
1.0	To educate about the Constitutional Law of India	**1.1**	Gain Knowledge about the Constitutional Law of India	f, h, l	
2.0	To motivate students to Understand the Fundamental Rights and Duties of a citizen	**2.1**	Understand the Fundamental Rights and Duties of a citizen	f, g, h	
3.0	To make students to understand about Federal structure of Indian Government	**3.1**	Apply the concept of Federal structure of Indian Government	f, g, h	
4.0	To understand about Amendments and Emergency provisions in the Constitution	**4.1**	Analyze the Amendments and Emergency provisions in the Constitution	f, g, h	
5.0	To educate a holistic approach in their life as a Citizen of India	**5.1**	Develop a holistic approach in their life as a Citizen of India	f, h, l	

UNIT I - INTRODUCTION TO INDIAN CONSTITUTION	**(6)**
Meaning of the constitution law and constitutionalism - Historical perspective of the Constitution - Salient features and characteristics of the Constitution of India	
UNIT II - FUNDAMENTAL RIGHTS	**(6)**
Scheme of the fundamental rights - Right to Equality - Fundamental Right under Article 19 - 102 Scope of the Right to Life and Liberty - Fundamental Duties and its legal status - Directive Principles of State Policy – Its importance and implementation	
UNIT III - FEDERAL STRUCTURE	**(6)**
Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary Form of Government in India - The constitutional powers and status of the President of India	
UNIT IV - AMENDMENT TO CONSTITUTION	**(6)**
Amendment of the Constitutional Powers and Procedure - The historical perspectives of the constitutional amendments in India	
UNIT V - EMERGENCY PROVISIONS	**(6)**
National Emergency, President Rule, Financial Emergency Local Self Government – Constitutional Scheme in India	
TOTAL(L:30)=30PERIODS	

TEXT BOOKS:

1. Basu D.D., “Introduction to the Constitution of India” ,Prentice Hall of India, 2001.
2. Briji Kishore Sharma, “Introduction to the Constitution of India”, Prentice Hall of India, 2005.
3. Jain. M. C., “The Constitution of India”, Law House, New Delhi, 2001.
4. Shukla. V. N., “Constitution of India”, 2011.

REFERENCES:

1. Constitution of India - Ministry of Law & Justice - PDF format, awmin.nic.in/coi/coiason29july08.pdf
2. The Constitution of India - Google free material - www.constitution.org/cons/india/const.html
3. Parliament of India - PDF format download.nos.org/srsec317newE/317EL11.pdf
4. Prof.Balkrishna, "The Role of the President of India".
5. Local Government in India – E Book - Pradeep Sachdeva https://books.google.com/books/.../Local_Government_in_In...

17CEC16 - STRUCTURAL ANALYSIS – II					
		L	T	P	C
		3	2	0	4
PREREQUISITE : 17CEC12		**QUESTION PATTERN : TYPE -4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To analyze the three hinged, two hinged and fixed arches.	**1.1**	Analyze of three hinged, two hinged and fixed arches	**a,b**
2.0	To analyse statically indeterminate structures by imposing boundary conditions on flexibility matrix.	**2.1**	Analysis simple determinate and indeterminate beams, frames and trusses using flexibility matrix method	**a,b,d**
3.0	To formulate the element stiffness matrix and assemble the structure matrix for solving indeterminate problems	**3.1**	Analysis simple determinate and indeterminate beams, frames and trusses using stiffness matrix method.	**a,b,d**
4.0	To analyse the suspension bridges and space truss	**4.1**	Determine the member forces in suspension bridges and space truss	**a,d,f**
5.0	To understand the basics of finite element method and its application to structural analysis.	**5.1**	Explain the basic concepts in finite element method	**a.b**

UNIT I - ARCHES	**(9+6)**
Arches as structural forms - Types of arches - Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches - Settlement and temperature effects.	
UNIT II - FLEXIBILITY METHOD	**(9+6)**
Concept of flexibility matrix – determinate Vs indeterminate - Analysis of indeterminate pin-jointed plane frames, analysis of continuous beams, rigid jointed plane frames.	
UNIT III - STIFFNESS METHOD	**(9+6)**
Stiffness matrix for beam element - analysis of continuous beams - plane frames and pin jointed plane frames.	
UNIT IV - SPACE AND CABLE STRUCTURES	**(9+6)**
Analysis of Space trusses using method of tension coefficients - Beams curved in plan - Suspension cables - suspension bridges with two and three hinged stiffening girders.	
UNIT V - INTRODUCTION OF FINITE ELEMENT METHOD	**(9+6)**
Introduction - Discretization of a structure - Displacement functions - Truss element - Beam element - Plane stress and plane strain - Triangular elements.	
	TOTAL (L: 45 + T:30) = 75 PERIODS

TEXT BOOKS:

1. Vaidyanathan, R and Perumal, P. "Comprehensive Structural Analysis," Volume I and II, Laxmi Publications Pvt. Ltd., Chennai, 4th ed., 2016.
2. V.N.Vazirani and M.M.Ratwani, "Analysis of Structures" Volume I and II, Khanna Publishers, New Delhi, 2015.
3. S.S.Bhavikatti, "Structural Analysis" - Vol. I & II, Vikas Publishing Pvt Ltd., New Delhi, 4th ed., 2013.

REFERENCES:

1. R.L.Jindal, "Indeterminate Structures", Tata Mc Graw Hill Publishing House, 1996.
2. Negi.L.S, "Theory & Problems in Structural Analysis", Tata McGraw Hill Publishing House, 2004.
3. G.S.Pandit & Gupta S.P, Structural Analysis (A Matrix Approach), Tata McGraw Hill, Publishing Ltd, 2008.

17CEC17 - DESIGN OF STEEL STRUCTURES [IS 800-2007 and Steel Tables are to be permitted]				
L	T	P	C	
3	2	0	4	

PREREQUISITE : 17CEC03 | **QUESTION PATTERN : TYPE -4**

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program outcomes
1.0	To study the design of bolted and welded connections.	**1.1**	Analyse the behaviour of bolted and welded connecting and design them,	**a,b,l**
2.0	To provide knowledge on design of tension members.	**2.1**	Know the concept of design of tension members	**a,b,l**
3.0	To get familiar with compression member design.	**3.1**	Design compression members using simple and built-up sections.	**a,b,g,l**
4.0	To study the behavior of flexural members and design the beams.	**4.1**	Design various types of flexural members.	**a,b,g,l**
5.0	To understand the design of industrial buildings.	**5.1**	Design Industrial structures and their components.	**g,j,l**

UNIT I - INTRODUCTION **(9+6)**

Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures – Connections using welding and bolting – Design of bolted and welded joints – Eccentric connections - Efficiency of joints

UNIT II - TENSION MEMBERS **(9+6)**

Types of sections - Net area - Net effective sections for angles and Tee in tension - Design of connections in tension members - Use of lug angles - Design of tension splice - Concept of shear lag.

UNIT III - COMPRESSION MEMBERS **(9+6)**

Types of compression members - Theory of columns - Basics of current codal provision for compression member design - Slenderness ratio - Design of simple and built up members - Design of laced and battened type columns - Design of column bases - Gusseted base - Anchor Bolts.

UNIT IV - BEAM **(9+6)**

Design of laterally supported and unsupported beams - Built up beams - Beams subjected to uniaxial and biaxial bending - Design of plate girders - Intermediate and bearing stiffeners - Flange and web splices.

UNIT V - ROOF TRUSS AND INDUSTRIAL BUILDING **(9+6)**

Roof trusses - Roof and side coverings - Introduction of Pre-Engineered Buildings - Design of purlins and elements of truss; end bearing - Design of gantry girder.

TOTAL (L: 45 + T:30) = 75 PERIODS

TEXT BOOKS:

1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.
2. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013

3. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd ed., 2013.
4. Bhavikatti.S.S, “Design of Steel Structures”, IK International Publishing House Pvt. Ltd., New Delhi 2010

REFERENCES:

1. Dr. L. S. Jayagopal, Dr. D. Tensing, “Design of Steel Structures”, Vikas Publishing House Pvt. Ltd., 2015
2. Narayanan.R "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002.
3. Duggal. S.K, “Limit State Design of Steel Structures”, Tata McGraw Hill Publishing Company, 2009
4. Shah.V.L and Veena Gore, “Limit State Design of Steel Structures”, IS 800–2007 Structures Publications, 2012.
5. IS 800:2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007

17CEC18 - DESIGN OF REINFORCED CONCRETE STRUCTURES [IS 456, SP 16 and IS 3370 Code Books are to be permitted]				
L	T	P	C	
3	0	0	3	

PREREQUISITE : 17CEC13	QUESTION PATTERN : TYPE -4

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand the basic concepts in the behavior and design of earth retaining structures.	1.1	Design counterfort and cantilever retaining walls.	a,b,c,g,l
2.0	To provide knowledge on design of various components in the water tank.	2.1	Design underground and overhead R.C water tanks for the given capacity	a,c,l
3.0	To provide knowledge on design of flat slab and raft foundations.	3.1	Design flat slabs as per IS standards	a,b,c,g,l
4.0	To explain the basic concepts about the yield line theory for the analysis and design of slab.	4.1	Analyze and design various types of slabs using yield line theory.	a,b,c,g,l
5.0	To design the slender column and industrial structures	5.1	Design columns for axial, uniaxial and biaxial bending and industrial structures	a,b,c,d,g,l

UNIT I - RETAINING WALLS	**(9)**
Functions of a Retaining Wall - Design of Cantilever and Counterfort Retaining walls	
UNIT II - WATER TANKS	**(9)**
Design principles of elevated overhead water tank - Design of rectangular underground water tank - Design of circular overhead water tank	
UNIT III - FLAT SLABS	**(9)**
Design of flat slabs (Problems) - Principles of design of Raft foundation, box culvert and road bridges	
UNIT IV - YIELD LINE THEORY	**(9)**
Assumptions - Characteristics of yield line - Determination of collapse load / plastic moment - Application of virtual work method - square, rectangular, circular and triangular slabs - Design problems	
UNIT V - SLENDER COLUMN AND INDUSTRIAL STRUCTURES	**(9)**
Design of Slender columns - Design for Uniaxial and Biaxial bending using Column Curves (Problems) - Bunkers – Basic Concepts - Silos - Design Principles	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Krishnaraju. N.,"Design of reinforced Concrete Structures", CBS Publishers and Distributors Pvt Ltd, 4th ed., 2015.
2. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2006.
3. Varghese.P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2012.

REFERENCES:

1. Ram Chandra.N and Virendra Gehlot, "Limit State Design", Standard Book House, 2004.
2. Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012
3. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
4. IS 456:2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2007
5. SP 16:1980, Design Aids for Reinforced Concrete, Bureau of Indian Standards, New Delhi.
6. IS 3370 (Part I & II):2009, Concrete Structures for Storage of Liquids - Code of Practice, Bureau of Indian Standards, New Delhi.

17CEC19 – ENVIRONMENTAL ENGINEERING					
		L	T	P	C
		3	0	2	4
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE -4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand the principles of water supply system and planning the sources	**1.1**	Recognize the water supply system, water sources and water quality characteristics and standards	**c,g**
2.0	To get knowledge in treatment of water.	**2.1**	Design various water treatment units.	**a,e,l**
3.0	To grasp the principles of collection, conveyance and treatment of wastewater.	**3.1**	Design the various primary treatment units for wastewater	**b,g**
4.0	To recognize the different primary and secondary treatment techniques of wastewater	**4.1**	Design and choose the various secondary treatment units for wastewater	**b,e,g**
5.0	To gain knowledge about solid waste disposal	**5.1**	Select suitable treatment units for disposal of sewage and sludge.	**b,f**

UNIT I - SOURCES AND QUALITY OF WATER	**(9)**
Public Water supply system –Intakes- Channels and pipes for conveying water - Planning, Objectives, Design period, Population forecasting - water demand –Sources of water – Surface and Ground water – Characteristics of water	
UNIT II - WATER TREATMENT	**(11)**
Water treatment Objectives – Unit operations and processes in surface water treatment – Principles, functions and design of flash mixers, flocculators, sedimentation tanks and sand filters – Aeration – iron and manganese removal, defluoridation.	
UNIT III - PRIMARY WASTE WATER TREATMENT	**(9)**
Characteristics of sewage, Primary treatment: Principles, functions and design of screen, grit chambers and primary sedimentation tanks-operation and maintenance aspects.	
UNIT IV - SECONDARY WASTE WATER TREATMENT	**(9)**
Activated Sludge Process and Trickling filter (no design); Other treatment methods - oxidation ditches, UASB -Waste Stabilization Ponds - Anaerobic Stabilization units - Septic tanks.	
UNIT V - DISPOSAL OF SEWAGE AND SLUDGE	**(7)**
Dilution – Self-purification of surface water bodies – Oxygen sag curve – disposal to lakes and sea, Land disposal – Sewage farming - characteristics of Sludge -Thickening – Sludge digestion – Sludge disposal - Drying beds – Conditioning and Dewatering.	

LIST OF EXPERIMENTS:

1. Determination of Turbidity by using Nephlometer
2. Measurement of pH and conductivity of water sample
3. Determination of Hardness by EDTA method
4. Determination of Alkalinity
5. Determination of Acidity in water
6. Determination of Chlorides
7. Determination of Residual chlorine

8. Determination of Optimum Coagulant by Jar test
9. Determination of Total, Dissolved and Suspended solids
10. Determination of Available chlorine in bleaching powder
11. Determination of Dissolved Oxygen and BOD for the given sample
12. Determination of COD for given sample

TOTAL(L:45 + P:30)= 75 PERIODS

TEXT BOOKS:

1. Garg, S.K., "Environmental Engineering", Vol.I and II, Khanna Publishers, New Delhi, 2005.
2. Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2010.
3. Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2013

REFERENCES:

1. Government of India, "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, New Delhi, 2013.
2. Syed R. Qasim and Edward M. Motley Guang Zhu, "Water Works Engineering Planning", Design and Operation, Prentice Hall of India Private Limited, New Delhi, 2006.
3. George Tchobanoglous, Franklin Louis Burton, H. David Stensel, Metcalf & Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw-Hill Edition, 4th ed., New Delhi, 2009.

17CEP07 - DESIGN AND DRAWING LABORATORY

[IS 456, SP 16, IS 1905 and IS 3370 codes books are to be permitted]

L	T	P	C
0	0	4	2

PREREQUISITE : 17CEC13

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand the structural detailing of structures like slab, beam, retaining wall, water tank, roof trusses, etc.	**1.1**	Design R.C retaining walls using software	**a,b,l**
2.0	To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice	**2.1**	Prepare structural drawings for various concrete structures using software	**c,e**
3.0	To impart fundamental knowledge on Design and Detailing of structural components	**3.1**	Design and draw the detailing of slab bridge	**b,c**
4.0	To explain about the detailing of various RC and Steel structures.	**4.1**	Design and draw the detailing of various types of water tanks	**a,b,c,l**
5.0	To understand the importance of detailing for various structural components using computer techniques.	**5.1**	Design steel structures of roof truss using software	**a,b,d,l**

LIST OF EXPERIMENTS:

1. Design and analysis of multistorey framed structure (Beam, Column and Slab)
2. Design and drawing of RCC cantilever type retaining walls with reinforcement details
3. Design of solid slab bridges for IRC loading and reinforcement details
4. Design and drafting of circular RCC water tanks
5. Design and drafting of Elevated Water Tank
6. Design and detailing of Roof Truss

Note: Manual Design and CAD Drawing

TOTAL(P: 60) = 60 PERIODS

TEXT BOOKS:

1. Krishnaraju,N. "Structural Design and Drawing, Universities Press, 2009.
2. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2015

REFERENCES:

1. Krishnamurthy, D., "Structural Design and Drawing - Vol. II and III, CBS Publishers, 2010.
2. ShahV L and Veena Gore,"Limit State Design of Steel Structures"IS 800-2007,Structures Publications, 2009.
3. IS 456:2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2007
4. IS1905:1987, Code of Practice for Structural use of Unreinforced Masonry, Bureau of Indian Standards, New Delhi, 2002
5. SP 16:1980, Design Aids for Reinforced Concrete, Bureau of Indian Standards, New Delhi.
6. IS 3370 (Part I & II):2009, Concrete Structures for Storage of Liquids - Code of Practice, Bureau of Indian Standards, New Delhi.

17CEP08 – SURVEY CAMP					
			L	T	P	C
			0	0	2	1
PREREQUISITE : 17CEC06					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To make give practical exposure on the application of various basic principles of survey in the field.	**1.1**	Conduct various types of surveys in the field as per the requirements		**c,e,g,l**
2.0	To practically apply various simple surveying techniques, both in field and construction industries	**2.1**	Conduct survey using Advanced Instruments		**b,d,e,g,l**
3.0	To measure and draw the longitudinal and cross sectioning	**3.1**	Prepare contour map for the given area.		**d,e,f,l**
4.0	To measure the horizontal and vertical angles for triangulation work	**4.1**	Apply the procedures involved in field work and to work as a surveying team.		**c,f,g,i,l**
5.0	To provide hands on experience to handle modern surveying equipments using total station	**5.1**	Calculate the distances and angles of an object using advanced Instruments		**c,e,l,l**

LIST OF EXPERIMENTS:

Ten days survey camp using theodolite, leveling and total station. At the end of the camp, each student shall have plot the contour map and calculate the area. The camp record shall include all original field observations, calculations and plots.

1. Triangulation
2. Trilateration
3. Contouring
4. Co-ordinates and distance measurement with GPS
5. Distance and angular measurement using Total Station
6. Layout Preparation of field using Total Station
7. Setting out works using Total Station

(Ten Days Survey Camp will be conducted during 5th Semester winter vacation)

TOTAL (P: 30) = 30 PERIODS

17GED06 – COMPREHENSION					
		L	T	P	C
		0	0	2	0
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.	**1.1**	Understand and comprehend any given problem related to Civil Engineering field.		**a,b,e,g,l**
2.0	To improve the skill of designing various problems related to Civil Engineering	**2.1**	Recall the fundamentals of Civil Engineering and Summarize the concepts of Codal provisions		**a,b,l**

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Friction and its applications; Kinematics of point mass and rigid body; Centre of mass; Euler's equations of motion; Supports and Reactions.

Mechanics of Solids: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Theories of failures; Simple bending theory, flexural and shear stresses, Uniform torsion, buckling of column, combined and direct bending stresses.

Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

Construction Materials: Structural steel - composition, material properties and behaviour; Concrete - constituents, mix design, Bricks and mortar; Timber; Bitumen.

Soil Mechanics: Origin of soils, Three-phase system and phase relationships, index properties; Indian standard soil classification system; Permeability Darcy's law; flow nets, Principle of effective stress, quicksand condition; Compaction in laboratory and field conditions; One- dimensional consolidation, Mohr's circle.

Foundation Engineering: Sub-surface investigations, Plate load test, standard penetration and cone penetration tests; Rankine Earth pressure theory;Stability of slopes - Stress distribution in soils - Boussinesq's, Pressure bulbs; Shallow foundations - Terzaghi's bearing capacity theories,; Combined footing and raft foundation; Contact pressure; Deep foundations - types of piles, dynamic and static formulae, pile load test, negative skin friction.

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.

Surveying: Principles of surveying; Distance and angle measurement - Levelling, Contouring, Total station.

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines, specific speed of pumps and turbines; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow.

Highway Pavements: Highway materials - desirable properties and quality control tests; Design factors for flexible and rigid pavements; Design of flexible pavement and rigid pavements.

Water and Waste Water: Sources and quality of water, water treatment, Primary Waste Water Treatment, Secondary Waste Water Treatment, Disposal of sewage and sludge.

Concrete Structures: Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length.

Steel Structures: Limit state design concepts; Design of tension and compression members, beams and beam-columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses.

METHOD OF EVALUATION:

The student will be assessed for his understanding of the basic principles of the core engineering subjects. The internal assessment for a total of 50 marks will be evaluated by a committee comprising of the faculty members of the department. The committee will conduct three written examinations of objective question type from the subjects.

The end semester examination, which carries a total of 50 marks, will be an objective question type examination conducted by a committee of one internal examiner appointed by the COE of our college.

TOTAL(P:30)=30 PERIODS

REFERENCES:

1. R.S.Khurmi, J.K.Gupta, "Civil Engineering (Conventional and ObjectiveType)", Eurasia Publishing House Pvt.Ltd, New Delhi, 2013.
2. R.Agor,"Conventional and Objective Type Questions and Answers on Civil Engineering", Khanna Publishers, 32nd ed., 2000.

17GED08 - ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE				
	L	T	P	C
	2	0	0	0

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To Understand the basics of Indian tradition and Indian traditional knowledge systems	**1.1**	Gain Knowledge about of Indian tradition and Indian traditional knowledge systems	a,f,h
2.0	Toknow about basics of technologies and its scientific perspectives.	**2.1**	Understand basics of technologies and its scientific perspectives.	a, f
3.0	To study the basics of Indian traditional health care.	**3.1**	Study the basics of Indian traditional health care	a,f,l
4.0	To know the basics of Indian artistic tradition knowledge	**4.1**	Know the basics of Indian artistic tradition	a,f,l
5.0	To develop the basics of linguistic tradition	**5.1**	Develop the basics of linguistic tradition	a,f,h

UNIT I - INDIAN TRADITION	**(6)**
Fundamental unity of India, India's heroic role in world civilization, The Indian way of life, Introduction to Indian tradition, The Scientific Outlook and Human Values.	
UNIT II - INDIAN KNOWLEDGE SYSTEM AND MODERN SCIENCE	**(6)**
Relevance of Science and Spirituality, Science and Technology in Ancient India, Superior intelligence of Indian sages and scientists	
UNIT III - INDIAN TRADITIONAL HEALTH CARE	**(6)**
Importance and Practice of Yoga, Pranayam and other prevailing health care techniques	
UNIT IV- INDIAN ARTISTIC TRADITION	**(6)**
Introduction and overview of significant art forms in ancient India such as painting, sculpture, Civil Engineering, Architecture, Music, Dance, Literature etc	
UNIT V - INDIAN LINGUISTIC TRADITION	**(6)**
Ancient Indian languages and literary Heritages, Phonology, Morphology, Syntax and Semantics	
TOTAL (L: 30)=30PERIODS	

Text Books:

1. Sivaramakrishnan, V., Cultural Heritage of India- Course Material, BharatiyaVidyaBhavan, Mumbai 5thed., 2014
2. Swami Jitatmananda, Modern Physics and Vedanta, BharatiyaVidyaBhavan, 2004.
3. Raman V.V., Glimpses of Indian Heritage, Popular Prakashan,1993
4. Jha V.N., *Language, Thought and Reality*
5. Krishna Chaitanya, *Arts of India*, Abhinav Publications, 1987

17CEC20 – ESTIMATING, COSTING AND VALUATION			
L	T	P	C
3	0	2	4

PREREQUISITE : 17CEP07 | **QUESTION PATTERN : TYPE-4**

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart the knowledge on basic concepts related to estimate preparation	**1.1**	Prepare the estimate corresponding to the required specification	**a,b,f,h,l**
2.0	To analyse the rate of a work item according to the specification	**2.1**	Arrive rates of various work items of civil Engineering works and familiarized with tendering	**b, c,e,g, i,k,l**
3.0	To understand the concepts behind the preparation of estimate of the various civil engineering works.	**3.1**	Prepare bills of quantities in construction works	**a,d,f,j,l**
4.0	To study the rate analysis, valuation of properties and preparation of reports for estimation of various items.	**4.1**	Predict the value of properties considering various influencing factors.	**b,e,f,l**
5.0	To understand the terminologies and concepts behind the valuation of properties, depreciation and time value of money	**5.1**	Get familiarized with report process.	**a,j,l**

UNIT I - INTRODUCTION TO ESTIMATES AND SPECIFICATIONS **(9)**

General introduction to Quantity surveying - purpose of estimates - Types of estimates, various items to be included in estimates - Principles in selecting units of measurement for items, various units and modes of measurement for different trades - I.S. 1200, Specifications - purpose and basic principles of general and detailed specifications - detailed specifications for various items of work.

UNIT II - RATE ANALYSIS AND TENDERS **(10)**

Analysis of rates, factors affecting the cost of materials, labour. Taskwork, schedule as basis of labour costs. Plants and equipment - hour costs based on total costs and outputs. Overhead charges, rates for various items of construction of civil engineering works. Standard schedule of rate, price escalation.

UNIT III - ESTIMATION OF CIVIL ENGINEERING WORKS **(9)**

Reading and interpretation of architectural and structural drawings - Detailed estimate of masonry buildings, R.C.C works, Preparation of schedule for steel as reinforcement - Preparation of bills of quantities - Approximate estimates, purpose, various methods used for buildings and other civil engineering works such as culvert and road projects – Estimating of irrigation works – aqueduct, siphon.

UNIT IV – VALUATION **(8)**

Principles of valuation, definition of value, price and cost - Attributes of value, Different types of values- Valuer and his duties, purpose of valuation and its function. Factors affecting the valuation of properties - free hold and leasehold properties, different types of lease - Methods of valuation - Forms of rent, different types of rent - carpet area basis, unit basis, cubic content basis - Sinking fund, Depreciation

UNIT V - REPORT PREPARATION **(9)**

Principles for report preparation - Report on estimate of residential building - Culvert - Roads - Water supply and sanitary installations - Tube wells - Open wells.

LIST OF EXPERIMENTS:

1. Rate analysis for earth work, PCC, RCC, Brick work, plastering and steel fabrication
2. Calculation of quantities and prepare the estimate for load bearing structure (Residential)
3. Calculation of quantities and prepare the estimate for framed structure (Commercial)
4. Prepare the bar-bending schedule for footing, column, plinth / roof beam and slab

TOTAL (L: 45+ P:30)= 75 PERIODS

TEXT BOOKS:

1. Birdie .G.S, "Text Book on Estimating and Costing", Dhanpat Rai Publishing Company, New Delhi, 2014.
2. Dutta, B.N., "Estimating and Costing in Civil Engineering (Theory and Practice)", UBS Publishers & Distributors Pvt. Ltd., New Delhi, 2016
3. Chakraborti .M," Estimating Costing, Specification and Valuation in Civil Engineering", Chakraborti Publishers., 2010.

REFERENCES:

1. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand & Company Ltd., 2014
2. Jogleka .P.T, "Practical Information for Quantity Surveyors", Mrs. Mandakini Joglekar, Pune, 1992.
3. Rangwala .S.C.," Estimating,Costing and Valuation", Charotar Publishing House, Anand, 2017.

17CEC21 - CONSTRUCTION TECHNIQUES, EQUIPMENT AND PRACTICE				
L	T	P	C	
3	0	0	3	

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE-3**

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To aware of the various construction techniques and practices needed for different types of construction activities	**1.1**	Know the different construction techniques and structural systems	**c,e,l**
2.0	To get knowledge about the various construction procedures for sub to super structure	**2.1**	Apply the various construction practices in the field.	**c,e,l**
3.0	To get idea for selection of equipment's for earthwork	**3.1**	Predict the equipment for different types of work	**b,e,l**
4.0	To study the equipment needed for construction of various types of structures from foundation to super structure.	**4.1**	Plan the requirements for substructure construction.	**c,g,l**
5.0	To know the different construction of structures and erection works.	**5.1**	Know the methods and techniques involved in the construction of various types of super structures	**b,e,l**

UNIT I - CONSTRUCTION TECHNIQUES **(9)**

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism - floor system - Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact of materials - responsible sourcing - Eco Building (Green Building) - Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Energy efficient buildings for various zones.

UNIT II - CONSTRUCTION PRACTICES **(9)**

Specifications, details and sequence of activities and construction co-ordination - Site Clearance - Marking - Earthwork - masonry - stone masonry - Bond in masonry - concrete hollow block masonry - flooring - damp proof courses - construction joints - movement and expansion joints - pre cast pavements - Building foundations - basements - temporary shed - centering and shuttering - slip forms - scaffoldings - de-shuttering forms - Fabrication and erection of steel trusses - frames - braced domes - laying brick - weather and water proof - roof finishes - acoustic and fire protection.

UNIT III - CONSTRUCTION EQUIPMENT **(9)**

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers - Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures – types of cranes - Equipment for dredging, trenching, tunneling.

UNIT IV - SUB STRUCTURE CONSTRUCTION **(9)**

Techniques of Box jacking - Pipe Jacking - under water construction of diaphragm walls and basement-Tunneling techniques - Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation

UNIT V - SUPER STRUCTURE CONSTRUCTION **(9)**

Launching girders, bridge decks, off shore platforms - special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks - Prefabricated panels and structures – production, transportation and erection of structures.

TOTAL (L: 45)= 45 PERIODS

TEXT BOOKS:

1. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 2010.
2. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2016.
3. Sharma S.C. “Construction Equipment and Management”, Khanna Publishers New Delhi, 2013

REFERENCES:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 2001.
2. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers,1999.
3. Deodhar, S.V. “Construction Equipment and Job Planning”, Khanna Publishers, New Delhi, 2012.
4. Mahesh Varma, “Construction Equipment and its Planning and Application”, Metropolitan Book Company, New Delhi, 1983.

17CED01 - DESIGN PROJECT				
	L	T	P	C
	0	0	8	4

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart and improve the design capability of the student.	**1.1**	Formulate a problem definition in the field of Civil Engineering through literature survey.	**a,j,l**
2.0	To design problem in any one of the disciplines of Civil Engineering, e.g., Design of an RCC Structure, Design of a waste water treatment plant, Design of a foundation system, Design of traffic intersection, Design of a Steel Structures, etc	**2.1**	Develop methodology using appropriate tools for the problem	**c, i,l**
3.0	The design problem can be allotted to either an individual student or a group of students comprising of not more than four.	**3.1**	Identify the objectives of the project by thorough understanding of the problem	**b,d,g**
4.0	The group should submit a complete report on the design problem consisting of the data given, the design calculations and specifications with complete set of drawings.	**4.1**	Gain sufficient idea on practice of various fields in civil Engineering.	**b,f,l**
5.0	To improve the skill of designing various problems related to Civil Engineering	**5.1**	Design the structures, draw the reinforcement detailing and find the Estimation of Buildings	b,j,l

This course conceives purely a design problem in any one of the disciplines of Civil Engineering; e.g., Design of an RC structure, Design of a waste water treatment plant, Design of a foundation system, Design of traffic intersection etc. The design problem can be allotted to either an individual student or a group of students comprising of not more than four. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.

EVALUATIONPROCEDURE

The method of evaluation will be as follows:

1. Internal Marks (Continuous Assessment) :50 marks
   (Decided by review committee consist of HoD, Guide and senior faculty member conducting 3 reviews)
2. End semester assessment (Evaluation of Project Report &Vivavoce examination) : 50 marks
   (Evaluated by the internal & external examiner appointed by the CoE and approval by HoI)

TOTAL: 100 MARKS

TOTAL (P: 120) = 120 PERIODS

17CEP09 – INDUSTRIAL TRAINING					
		L	T	P	C
		0	0	2	0
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**	
1.0	To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks.	**1.1**	Better experience in practical knowledge and construction needs.	**e,i,l**	
2.0	To develop skills in facing and solving the field problems	**2.1**	The intricacies of implementation textbook knowledge into practice	**c,e,l**	
3.0	The group should submit a complete report on the practical training.	**3.1**	The concepts of developments and implementation of new techniques	**d,e,l**	

STRATEGY:

The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

EVALUATION PROCEDURE

The Industrial Training shall carry 100 marks and shall be evaluated through internal assessment.

The method of evaluation will be as follows:

1. Evaluation of Industrial Training Report : 50 marks
   (Evaluated by the Internal examiner)
2. Power Point Presentation : 50 marks
   (Evaluated by the internal examiner appointed by the HoD with the approval of HoI and the CoE)

TOTAL: 100 MARKS

TOTAL(P: 30) = 30 PERIODS

17CEP10 - EMPLOYABILITY SKILLS – II				
	L	T	P	C
	0	0	2	0

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To instruct and improve the estimating and planning capability of the student.	**1.1**	Gain basic knowledge in planning and designing	c,g,j
2.0	To arrive a quantity of RCC / Steel using software	**2.1**	Gain sufficient idea on estimation of RCC / Steel Structure	a,h,j,l
3.0	Proficiently project management software packages.	**3.1**	Proficiently use Excel to undertake engineering calculations.	b,d,i,l

LIST OF EXPERIMENTS:

1. To design a RCC Building more than (G +1) or Industrial building with roof truss using any design software's, from that data is to submit the following
   a. Working Plan
   b. Structural layout (Skeleton) view
   c. Maximum Shear force, bending moment and deflection views
   d. RCC and Steel detailing for RCC Structures and Steel section detailing for Industrial buildings
2. To calculate the quantity and prepare the estimate of a RCC Building more than (G +1) or Industrial building with roof truss using software, from that data is to submit the following
   a. Working Plan
   b. Detailed measurement sheet
   c. Abstract
   d. Scheduling

The method of evaluation will be as follows:

1. Evaluation of Report : 80 marks
2. Viva voce examination : 20 marks

TOTAL: 100 MARKS

TOTAL(P: 30) = 30 PERIODS

17CED02 - PROJECT WORK				
L	T	P	C	
0	0	16	8	

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To provide students an opportunity to exercise their creative and innovative qualities in a group project environment.	**1.1**	Identify the objectives of the project by thorough understanding of the problem.	**b,f,l**
2.0	To excite the imagination of aspiring engineers, innovators and technopreneurs	**2.1**	Develop methodology using appropriate tools for the problem	**e,f,l**
3.0	To impart and improve the design capability of the student.	**3.1**	Take up any challenging practical problems and find solution based on literature.	**c,f,g**
4.0	To train the students in preparing project reports and to face reviews and viva voce examination.	**4.1**	Analyze the problem based on the methodology and tabulate the results	**c,f,j**
5.0	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same	**5.1**	Conclude the results and submit the project report	**d,j,l**

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.

EVALUATIONPROCEDURE

The method of evaluation will be as follows:

1. Internal Marks (Continuous Assessment) :50 marks
   (Decided by review committee consist of HoD, Guide and senior faculty member conducting 3 reviews)
2. End semester assessment (Evaluation of Project Report &Vivavoce examination) : 50 marks
   (Evaluated by the internal &external examiner appointed by the CoE and approval by HoI)

TOTAL:100MARKS

TOTAL (P:240) = 240 PERIODS

LIST OF PROGRAM SPECIFIC ELECTIVES (PSE)

17CEX01 – ARCHITECTURE AND TOWN PLANNING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart knowledge on the fundamentals of visual perception and principles.	**1.1**	Understand the various elements of architecture and principles of orientation.	**d,e,g,l**
2.0	To demonstrate competency in the technical, practical skills of landscape architecture and their role in investigating complex and innovative ideas.	**2.1**	Choose the various building materials as per the interior design aspects.	**c,g,l,**
3.0	To give exposure about architectural principles in the design of buildings.	**3.1**	Make plan for the buildings by considering our Indian climatic conditions	**c,d,e,g**
4.0	To suggest the land requirement as per the zoning regulations.	**4.1**	Solve the problem that is coming in Town Planning level	**d,g,k,l**
5.0	To understand the design approach of various building types with specific reference to site and climate	**5.1**	Know various rules and regulation of town planning and development authorities.	**c,h,l**

UNIT I - INTRODUCTION TO ARCHITECTURE	**(9)**
Fundamentals concepts of architecture – Principles of planning – Qualities, Strength, Refinement, Repose, Scale, Proportion, Colour, Solids and Voids and Symmetry	
UNIT II - INTERIOR DECORATIONS	**(9)**
Interior Planning and treatment - Use of natural and synthetic building materials – Thermal and Acoustical materials - Lighting & illumination	
UNIT III - PLANNING AND CONCEPTS OF TOWN PLANNING	**(9)**
Planning Surveys - Importance of Climate topography, drainage and water supply in the selection of site for the development - Residential - Commercial – Industrial – Public – Transportation, Basic amenities and services	
UNIT IV - FUNCTIONAL PLANNING OF BUILDINGS	**(9)**
Occupancy classification of buildings-general requirements of site and building – building codes and rules – licensing of building works. Functional planning of building such as residential, institutional, public, commercial, industrial buildings – the process of identifying activity areas and linkages	
UNIT V - COUNTRY PLANNING AND HOUSING	**(9)**
Plan implementation: Town planning legislation and municipal acts – Planning control development schemes – Urban	

financing – Land acquisitions – Slum clearance schemes. Examples of planned cities and housing in India – Applications of Remote Sensing and GIS in town planning

TOTAL(L: 45) = 45 PERIODS

TEXT BOOKS:

1. Pramar. V.S. "Design fundamental in Architecture", Somiya Publications Pvt. Ltd., New Delhi, 1997.
2. G.K. Hiraskar, "Fundamentals of Town Planning", Dhanpat Rai Publications Pvt.Ltd., New Delhi.,2012
3. M. Anji Reddy, Remote sensing and Geographical Information Systems, Third Edition, BS Publications, India, 2006

REFERENCES:

1. Arthur Gallion., Simon Eisner., "The Urban Pattern: City Planning and Design", Charotar Publishing House Pvt. Ltd., Gujarat, 5th ed., 1986.
2. Biswas Hiranmay, "Principles of Town Planning and Architecture" ,VAYU Education of India, New Delhi., 1st ed., 2012
3. S.C.Rangwala, K.S.Rangwala and P.S.Rangwala, 'Town Planning", Charotar Publishing House, 18th ed., 2003.
4. National Building Code of India, SP7 (Group 1) Bureau of Indian Standards, New Delhi, 2017

17CEX02 – REMOTE SENSING AND GIS TECHNIQUES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To study the basics of EMR and its interaction with atmospheric windows.	**1.1**	Analyze Electromagnetic radiations and their interactions with atmosphere.	**c,d,e,g, i,k,l**
2.0	To impart the knowledge on basics of platforms and sensors.	**2.1**	Classify and apply passive and active sensors.	**e,g,l,k,l**
3.0	To provide the knowledge on interpretation of images	**3.1**	Interpret and analyze the images	**e,g,l,k**
4.0	To get introduced on basic concepts of GIS.	**4.1**	Have basic idea about the fundamentals of GIS.	**a,b,d,g**
5.0	To understand the process of storage and analysis of various data.	**5.1**	Analyze data models for different studies	**b,h,l**

UNITI - INTRODUCTION TO REMOTE SENSING	**(12)**
Energy Sources and Radiation principles – electromagnetic radiation – characteristic of real remote sensing system, platforms & sensors - Airborne space borne, TIR and microwave sensors, satellite - Pay load description of important Earth Resources and Meteorological satellites	
UNIT II - PHOTOGRAMMETRY	**(8)**
Geometric elements of a vertical photograph – Ortho photos & Flight planning - Stereoscopic plotting instruments	
UNIT III - IMAGE INTERPRETATION	**(8)**
Elements of visual image interpretation, concepts of digital image processing image Rectification and Restoration, Image enhancement & Image classification. Application of Remote sensing in Civil Engineering.	
UNIT IV - INTRODUCTION TO GIS	**(9)**
Introduction to GIS - history of development of GIS - elements of GIS, Computer hardware – Software, Data Input, Verification, data storage and database management and output	
UNIT V - GIS ANALYSIS AND APPLICATIONS	**(8)**
Map Overlay - Vector and raster data model, mapping concept - Definitions – Map projections - types of map projections – map analysis, overlay operation Errors and quality control – Current issues and Trends in GIS application in Civil Engineering	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Bhatta. B, “Remote Sensing and GIS”, Oxford University Press, Second Edition 2011.
2. AnjiReddy.M., “Remote Sensing and Geographical information systems”, BS Publications 2013

REFERENCES:

1. Lillesand, T.M. & Kiefer R.W., “Remote Sensing and image interpretation”, John Wiley & Sons (Asia), Newyork, 2015.
2. Burrough P.A., Principle of Geographical Information Systems for land resources assessment, Clarendon Press, Oxford University Press, 2004

17CEX03 – CONSTRUCTION PLANNING AND SCHEDULING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To study the necessity of the planning in the diverse construction projects.	**1.1**	Understand basic concepts of construction planning.	**b,i,l**
2.0	To know the appropriate techniques used for scheduling the resources	**2.1**	Schedule the construction activities.	**c,j,k**
3.0	To have exposure on various cost control methods and accounting.	**3.1**	Forecast and control the cost in a construction.	**b,i**
4.0	To study the quality control and monitoring techniques	**4.1**	Understand about quality control and its safety during construction	**a,h,j,k,l**
5.0	To make awareness among the learners about management information system.	**5.1**	Organize information in Centralized database Management systems	**c,f**

UNIT I - CONSTRUCTION PLANNING	**(9)**
Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks – Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems..	
UNIT II - SCHEDULING PROCEDURES AND TECHNIQUES	**(9)**
Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity – on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost tradeoffs -Improving the Scheduling process – Introduction to application software.	
UNIT III - COST CONTROL MONITORING AND ACCOUNTING	**(9)**
The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.	
UNIT IV - QUALITY CONTROL AND SAFETY DURING CONSTRUCTION	**(9)**
Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.	
UNIT V - ORGANIZATION AND USE OF PROJECT INFORMATION	**(9)**
Types of project information-Accuracy and Use of Information-Computerized organization and use of Information - Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 2005
2. Srinath,L.S., "Pert and CPM Principles and Applications", Affiliated East West Press, 2001

REFERENCES:

1. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
2. Moder.J., Phillips. C. and Davis E, "Project Management with CPM", PERT and Precedence Diagramming,VanNostrand Reinhold Co., 3rd ed., 1985.
3. Willis., E.M., "Scheduling Construction projects", John Wiley and Sons, 1986.

17CEX04 – TRAFFIC ENGINEERING AND MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To introduce the fundamentals related to the traffic flow.	**1.1**	Analyse traffic problems and plan for traffic systems various uses	**a,b,c,e,g,l**
2.0	To provide knowledge on traffic signals and its operation	**2.1**	Plan and design the traffic signal duration	**a,b,i,l**
3.0	To create awareness about the control measures for traffic flow and fundamentals of traffic engineering	**3.1**	Practice the traffic engineering and practice the control measures	**e,g**
4.0	To impart knowledge on accident risk and its' management	**4.1**	Analyse the causes and report the accident.	**b,f,l**
5.0	To provide knowledge on Traffic management measures.	**5.1**	Manage the traffic congestion using the available management measures	**g,i,**

UNIT I - TRAFFIC STUDIES	**(9)**
Road user and Vehicle Characteristics - Traffic Studies -Traffic volume and composition - speed, Headway - Concentration and Delay and Flow principles - Capacity and level of service.	
UNIT II -TRAFFIC SIGNALS	**(9)**
Traffic signals- types- advantages –signal indications- signal setting for an intersection-fixed time signals.Co-ordination of signals- types- area traffic control - delay at signalized intersection.	
UNIT III -TRAFFIC ENGINEERING AND CONTROL	**(9)**
Review of various traffic surveys - traffic Studies - traffic engineering and their applications – distributions – roundabouts. Traffic signs-importance-principles-types-road markings and its types.	
UNIT IV - ACCIDENTS AND ROAD SAFETY	**(9)**
Accident – causes - reporting system - types of accidents - recording system- preventive measures. accident cost -road safety- road users - awareness- road users cost. Collection of accident data- road and its effect on accidents	
UNIT V - TRAFFIC SYSTEM MANAGEMENT	**(9)**
Traffic system management -various measures – scope - relative merits and demerits. Highway capacity - passenger car units (PCU) - level of service - factor affecting capacity -level of service- influence of mixed traffic.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Kadiyali.L.R. "Traffic Engineering and Transportation Planning", Khanna Publishers, 2014.
2. Subhash Saxena, "A Course in Traffic Engineering and Design", Dhanpat Rai & Sons, 2010

REFERENCES:

1. Pratab Chraborthy & Animesh Das, Principles of Transportation Engineering, Tata McGraw Hill Co, 2004.
2. S.K.Sharma, "Principles, Practice and design of highway Engineering", S.Chand& Co Ltd, New Delhi, 1998.
3. S.K. Khanna & E.G. Justo, Highway Engineering, Nemchand Brothers, Roorkee, 1998.

17CEX05 – GROUND IMPROVEMENT TECHNIQUES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE - 4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To demonstrate about the ground improvement techniques for soil condition	**1.1**	Find out the methods and selection of ground improvement techniques based on soil condition	**b,c,d,e,l**
2.0	To know about the drainage and dewatering techniques.	**2.1**	Understand dewatering techniques and design for simple cases.	**d,k,l**
3.0	To study the Insitu treatment methods in cohesion and cohesion less soils	**3.1**	Get knowledge on insitu treatment of cohesionless and cohesive soils.	**e,k,l**
4.0	To use the earth reinforcement and grout techniques	**4.1**	Understand the concept of earth renforcement and design of reinforced earth.	**c,d,l**
5.0	To study the various ways and means of improving the soil characteristics	**5.1**	Get knowledge on types of grouts and grouting technique.	**b,d,l**

UNIT I - INTRODUCTION	**(9)**
Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnical problems in alluvial, laterite and black cotton soils -Selection of suitable ground improvement techniques based on soil condition.	
UNIT II - DRAINAGE AND DEWATERING	**(9)**
Drainage techniques - Well points - Vaccum and electro-osmotic methods - Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only).	
UNIT III - INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOIL	**(9)**
Insitu densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation - Vibrofloation - Sand pile compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.	
UNIT IV - EARTH REINFORCEMENT	**(9)**
Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth – use of Geotextiles for filtration, drainage and separation in road and other works.	
UNIT V - GROUT TECHNIQUES	**(9)**
Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring – Stabilisation with cement, lime and chemicals - Stabilisation of expansive soils	
	TOTAL(L:45) = 45 PERIODS

TEXT BOOKS:

1. Das, B.M., "Principles of Foundation Engineering", Thomson Books / Cole, 2003.
2. Purushothama Raj, P. "Ground Improvement Techniques", Tata McGraw-Hill Publishing Company, New Delhi, 1995

REFERENCES:

1. Koerner R.M., “Construction and Geotechnical Methods in Foundation Engineering”, McGraw-Hill, 1994.
2. Moseley M.P., “Ground Improvement Blockie Academic and Professional”,Chapman and Hall, Glassgow, 1993.
3. Jones J.E.P., “Earth Reinforcement and Soil Structure”, Butterworths, 1995.
4. Koerner, R.M., “Design with Geosynthetics”, 3rd ed., Prentice Hall, New Jersey, 2002
5. Jewell, R.A., “Soil Reinforcement with Geotextiles”, CIRIA special publication, London, 1996

17CEX06 – HOUSING PLANNING AND MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To train the students to have a comprehensive knowledge of housing projects.	**1.1**	Plan and design the housing projects as per regulations.	**c, l**
2.0	To give awareness about the existing housing programmes.	**2.1**	Design the various housing programme with sustainability concepts	**a,c,g,l**
3.0	To train the students to do the planning and design of housing projects	**3.1**	Formulate and design the housing layouts by conducting site analysis	**b,d,i,l**
4.0	To give exposure on cost effective construction materials and methods.	**4.1**	Evaluate the suitability of various cost effective construction materials.	**c,e,f**
5.0	To train the students to perform the project appraisal of housing projects.	**5.1**	Perform the economic analysis based project appraisal of housing projects.	**c,e,l**

UNIT I - INTRODUCTION TO HOUSING	**(9)**
Definition of Basic Terms - House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing - Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.	
UNIT II - HOUSING PROGRAMMES	**(9)**
Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods - Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing & Slum Housing Programmes - Slum improvement - Slum redevelopment and Relocation - Use of GIS and MIS in Slum Housing Projects, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing - Role of Non - Government Organizations in slum housing.	
UNIT III - PLANNING AND DESIGN OF HOUSING PROJECTS	**(9)**
Formulation of Housing Projects - Land Use and Soil suitability analysis - Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Designs of Housing Units (Design Problems) - Housing Project Formulation.	
UNIT IV - CONSTRUCTION TECHNIQUES AND COST EFFECTIVE MATERIALS	**(9)**
New Constructions Techniques - Cost Effective Modern Materials and methods of Construction - Green building concept- Building Centers - Concept, Functions and Performance Evaluation.	
UNIT V - HOUSING FINANCE AND PROJECT APPRAISAL	**(9)**
Evaluation of Housing Projects for sustainable principles - Housing Finance, Cost Recovery - Cash Flow Analysis, Subsidy and Cross Subsidy - Public Private Partnership Projects - Viability Gap Funding - Pricing of Housing Units (Problems).	
TOTAL (L:45)= 45 PERIODS	

TEXT BOOKS:

1. Meera Mehta and Dinesh Mehta, "Metropolitan Housing Markets", Sage Publications Pvt. Ltd., New Delhi, 2000.
2. Francis Cherunilam and Odeyar D Heggade, "Housing in India", Himalaya Publishing House, Bombay, 2001.

REFERENCES:

1. Wiley- Blackwell, "Neufert Architects" Data, 4th ed., Blackwell Publishing Ltd, 2012
2. Donald Watson and Michael J. Crosbie, "Time Saver Standards for Architectural Design", 8th ed., Tata McGraw Hill ed., 2011
3. Walter Martin Hosack, "Land Development Calculations", McGraw Hill 2nd ed., USA 2010
4. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2004.
5. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS Habitat, Nairobi, 1994

17CEX07 – RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING				
L	T	P	C	
3	0	0	3	
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To give exposure to railway planning, geometric design, railway track construction, maintenance.	**1.1**	Understand the methods of route alignment and design elements in Railway Planning and Constructions	**c,e,h,l**
2.0	To understand the modern methods of railway construction.	**2.1**	Understand the Construction techniques and Maintenance of Track laying and Railway stations.	**a,b,e,l**
3.0	To prepare layout for airport and classification.	**3.1**	Gain an insight on the planning and site selection of Airport Planning and design.	**a,b,f,g**
4.0	To prepare geometric design for runway.	**4.1**	Analyze and design the elements for orientation of runways and passenger facility systems.	**a,e,l**
5.0	To provide knowledge on various components of harbour and ports.	**5.1**	Understand the various features in Harbours and Ports, their construction, coastal protection works and coastal Regulations to be adopted.	**b,c,e,l**

UNIT I - RAILWAY PLANNING AND DESIGN	**(10)**
Significance of Road, Rail, Air and Water transports - Elements of permanent way - Rails, Sleepers, Ballast, rail fixtures and fastenings - Track Stress, coning of wheels, creep in rails, defects in rails - Route alignment surveys, conventional and modern methods- Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.	
UNIT II - RAILWAY CONSTRUCTION AND MAINTENANCE	**(9)**
Tunneling Methods, drainage and ventilation - Materials required for track laying - Construction and maintenance of tracks –Modern methods of construction and maintenance - Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.	
UNIT III - AIRPORT PLANNING	**(8)**
Air transport characteristics-airport classification-airport planning: objectives, components, airport layouts - apron, terminal building, hangars, motor vehicle parking area and circulation pattern, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations.	
UNIT IV - AIRPORT DESIGN	**(8)**
Runway Design: Orientation, Wind Rose Diagram (Problems) - Runway length - Problems on basic and Actual Length, Geometric design of runways, Configuration - Elements of Taxiway Design - Airport Zones - Passenger Facilities and Services - Runway and Taxiway Markings and lighting.	
UNIT V - HARBOUR ENGINEERING	**(10)**
Definition of Basic Terms: Harbor, Port, Satellite Port, Docks, Waves and Tides - Planning and Design of Harbours: Requirements, Classification - Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage - mooring, types of mooring – Navigational aids- Inland Water Transport - Wave action on Coastal Structures, Coastal zone regulations and Coastal Protection Works.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", DhanpatRai and Sons, Delhi, 2010
2. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee, 2012.
3. Bindra S P, "A Course in Docks and Harbour Engineering", DhanpatRai and Sons, New Delhi, 2013

REFERENCES:

1. Rangwala, "Railway Engineering", Charotar Publishing House, 2013.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 2013.
3. Rangwala, "Harbor Engineering", Charotar Publishing House, 2013.
4. Oza.H.P. and Oza.G.H., “A Course in Docks and Harbour Engineering”, Charotar Publishing Co., 2013

17CEX08 – GREEN BUILDINGS				
L	T	P	C	
3	0	0	3	

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE-3**

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand about the concepts and need of green buildings in environment	**1.1**	Get exposure about green building requirements	**e,g,l**
2.0	To impart required knowledge on assessment of green buildings	**2.1**	Identify the materials and design strategies	**b,c,g**
3.0	To impart knowledge on the sustainable construction strategies	**3.1**	Study about implementation of green building systems	**a,g,k,l**
4.0	To study about the various assessment strategies	**4.1**	Learn the concept and assessment of standards.	**b,e,g**
5.0	To get knowledge about cost management.	**5.1**	Apply to environmental benefits	**g,l**

UNIT I – INTRODUCTION	**(9)**
Historical Perspective Buildings. Conventional versus Green Buildings – Comparison. Minor and major aspects of Green Buildings – The Integrated Design Process. Green Building Requirements. Conventional - Contemporary and Future Ecological Design – Green Design to Regenerative Design	
UNIT II - GREEN BUILDING SYSTEMS	**(9)**
Sustainable sites and landscaping – Enhancing ecosystems. Building envelops – selection of green materials, products and applications. Passive design strategies. Internal load reduction – Indoor environment quality. Building water and waste water management. Use of LEED / IGBC standards	
UNIT III - GREEN BUILDING IMPLEMENTATION	**(9)**
Site Planning, Health and Safety Planning, Construction and Demolition. Waste Management – Reducing the Footprint of Construction Operations – Maximizing the Value of Building Commissioning. HVAC Systems, Lighting and cleaning systems for green buildings. Costs and Benefits of Building Commissioning – use of LEED / IGBC standards	
UNIT IV - GREEN BUILDING ASSESSMENT	**(9)**
International Building Assessment Systems – The USGBC/ LEED Building Assessment Standard – The LEED Certification Process – The Green Globes Building Assessment Protocol- Example of a Platinum / Gold / Silver Building. Comparison of present Building Rating Systems – Code compilation requirements – Leed Griha	
UNIT V - ECONOMICS OF GREEN BUILDINGS	**(9)**
Economic aspects of Green Buildings – Quantifying Green Building Benefits – Managing Costs and Barriers. Short and long term environment benefits. Some typical case studies of Green Buildings	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Jerry Yudelson, “Green Buildings A to Z”, Understanding the buildings, 2008.
2. Jerry Yudelson, “Green Buildings through Integrated Design”, Tata McGraw Hill, New Delhi, 2008.
3. “Green building guidelines: Meeting the demand for low-energy, resource-efficient homes”, Sustainable Buildings Industry Council, 2004.
4. Means R.S., “Green building: project planning and cost estimating: a practical guide to materials, systems and standards”, 2nd ed.,, Kingston, Mass., 2006.

REFERENCES:

1. Alex Wilson and Mark Peipkorn, “Green Building Products: The Green Spec guide to residential building materials”, 2nd edition, Gabriola Island.
2. Jane Anderson, David E. Shiers, and Mike Sinclair, “The green guide to specification: an environmental profiling system for building materials and components”, 3rd edition., Oxford; Malden, MA: Blackwell Science, 2002.
3. Charles J. Kibert, “Sustainable Construction: Green Building Design and Delivery”, 2nd edition., Wiley, 2007

17CEX09 – SMART MATERIALS AND STRUCTURES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To provide the fundamentals of the smart materials	**1.1**	Understand the fundamentals of Smart materials.		**e,g,l**
2.0	To understand the strain measuring techniques	**2.1**	Understand the concepts of strain measuring techniques		**b,c,g,**
3.0	To give exposure to select suitable sensor for analyzing problems.	**3.1**	Suggest suitable sensors for various applications.		**c,d,e**
4.0	To enable to select and use the different actuator material.	**4.1**	Adapt the different actuator material in structural components		**a,b,c,e**
5.0	To introduce signal processing and control system in smart structures.	**5.1**	Apply signal processing and control system in smart structures.		**a,b,d,l**

UNIT I - INTRODUCTION	**(9)**
Introduction of Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration –Actuation systems and effectors	
UNIT II - MEASURING TECHNIQUES	**(9)**
Strain Measuring Techniques using Electrical strain gauges, Types – Resistance –Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.	
UNIT III - SENSORS	**(9)**
Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVOT – Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.	
UNIT IV- ACTUATORS	**(9)**
Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electro orheological Fluids– Electromagnetic actuation – Role of actuators and Actuator Materials.	
UNIT V- SIGNAL PROCESSING AND CONTROL SYSTEMS	**(9)**
Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Non-Linear.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. L. S. Srinath – Experimental Stress Analysis – Tata McGraw-Hill, New Delhi,1998.
2. A.V. Srinivasan, Smart Structures: Analysis and Design, Cambridge University Press, Cambridge; New York, 2001

REFERENCES:

1. Green building guidelines: Meeting the demand for low-energy, resource-efficient homes", Sustainable Buildings Industry Council, 2004.
2. Charles J. Kibert, "Sustainable Construction: Green Building Design and Delivery", 2nd edition., Wiley, 2007
3. Brain Culshaw – Smart Structure and Materials Artech House, Boston. London-1996.
4. J. W. Dally & W. F. Riley – Experimental Stress Analysis, Tata McGraw-Hill, New Delhi,1998

17CEX10 – INDUSTRIAL WASTE TREATMENT AND DISPOSAL					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To acquire a detailed knowledge on the current practices in industrial wastewater treatment.	**1.1**	Implement sophisticated wastewater treatment technology.	**b,d,l,**
2.0	To know the various processes of wastewater treatment and the engineering requirements for that treatment facilities.	**2.1**	Conduct waste audit in an industry and implement waste minimization techniques	**b,d,g**
3.0	To provide adequate knowledge about phenomena of atmospheric environment and treatment, sources, characteristics and treatment processes of various types of industries.	**3.1**	Learn new techniques for collection, recycling and disposal of waste and sludge	**c,k**
4.0	To deal with the polluting potential of major industries and methods control the pollution.	**4.1**	Prevent and control industrial effluents and hazardous wastes implementing environmental legislations.	**a,c,i**
5.0	To select suitable treatment methods for low, medium and high polluting industries	**5.1**	Identify the common effluent treatment plant for the industries	**b,j,k**

UNIT I – INTRODUCTION	**(9)**
Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health– Environmental legislations related to prevention and control of industrial effluents and hazardous wastes – Pollution Control Boards.	
UNIT II - WASTE MANAGEMENT APPROACH	**(8)**
Waste management approach – Waste Audit – Volume and strength reduction – material and process modifications – Recycle, reuse and byproduct recovery – Applications.	
UNIT III - TREATMENT TECHNIQUES	**(10)**
Equalisation – Neutralisation – Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption – Removal of dissolved inorganic solids – Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Secured landfills – Legal Provisions	
UNIT IV - HAZARDOUS WASTE MANAGEMENT	**(8)**
Hazardous wastes - Types of Wastes – Sources of wastes / Methods of Handling - Physio chemical treatment – solidification – incineration – Secured land fills	
UNIT V - CASE STUDY FROM MAJOR INDUSTRIES	**(10)**
Sources & their Characteristics, waste treatment flow sheets for selected industries such as textiles, tanneries, dairy, sugar, paper, distilleries, steel plants, refineries, fertilizer, and thermal power plants – wastewater reclamation concepts.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. M.N.Rao & A.K.Dutta “Wastewater Treatment”, Oxford IBH Publication, 1995.
2. Eckenfelder W.W,“Industrial Water Pollution Control”,McGrawHill Book Company, New Delhi, 2000.
3. Manivasakam N, “Industrial Effluents”, Sakthi Publications, Coimbatore, 1997

REFERENCES:

1. T.T.Shen,, “Industrial Pollution Prevention”, Springer publications, 1999
2. R.L.Stephenson & J.B.Blackburn Jr., Industrial Wastewater Systems Hand book, Lewis Publishers, New York, 1998
3. H.M.Freeman, “Industrial Pollution Prevention Hand Book”, McGraw Hill Inc., New Delhi, 1995.
4. Bishop, P.L., “Pollution Prevention: Fundamental & Practice”, McGraw Hill, 2000.

17CEX11 – GROUND WATER ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand various hydrogeological parameters and their estimation	**1.1**	Estimate the various aquifer parameters	**a,b,c**
2.0	To impart knowledge of well hydraulics	**2.1**	Analyze the steady and unsteady state of flow into a well.	**a,b,e,l**
3.0	To be familiar with various ground water management techniques	**3.1**	Apply mathematical models for ground water management	**a,b,c,l**
4.0	To provide information on ground water quality and its application	**4.1**	Implement various saline water prevention techniques	**a,b,d**
5.0	To emphasis the importance of ground water conservation	**5.1**	Adopt appropriate rainwater harvesting techniques	**a,c,d,l**

UNIT I - HYDROGEOLOGICAL PARAMETERS	**(9)**
Introduction – water bearing Properties of Rock – Type of aquifers – Aquifer properties – Permeability, specific yield, transmissivity and storage coefficient – methods of Estimation – Ground water table fluctuation and its interpretations – ground water development and Potential in India – GEC norms	
UNIT II - WELL HYDRAULICS	**(9)**
Objectives of Ground water hydraulics – Darcy's Law – Ground water equation – steady state flow – DupuitForchheimer assumption – unsteady state flow – thesis method – Jacob method	
UNIT III - GROUND WATER MANAGEMENT	**(9)**
Need for management model- Database for groundwater management – ground water balance study – Introduction to mathematical model – Conjuctive use – Collector well and infiltration gallery.	
UNIT IV - GROUNDWATER QUALITY	**(9)**
Groundwater chemistry – origin, movement and quality – water quality standards – health and aesthetic aspects of water quality – Saline intrusion – Environmental concern and regulatory requirements	
UNIT V - GROUNDWATER CONSERVATION	**(9)**
Artificial recharge techniques – Remediation of Saline Intrusion – Groundwater management studies – protection zone delineation, Contamination source inventory, remediation schemesGround water Pollution and legislation.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Raghunath H.M., "Ground water Hydrology", New Age International (P) Ltd. New Delhi 2010
2. Ramakrishnan, S, Ground water, K.J. Graph arts, Chennai 1998.

REFERENCES :

1. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.
2. Fitts R Charles, "Groundwater Science", Elsevier, Academic Press, 2002.

17CEX12 – SOLID WASTE MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcome
1.0	To understand the effects of poor waste management and types of solid waste	**1.1**	Classify solid wastes explain the functional elements of SWM and determine the effects of poor waste management on public health and the environment.	**c,g,i**
2.0	To Identify the components of a waste collection system	**2.1**	Evaluate how a collection system is planned, implemented and maintain the required data for record keeping and inventory control.	**a,b**
3.0	To recognize the collection system for waste management	**3.1**	Discuss the various components of a waste collection system and to explain the characteristics of waste containers relative to their use.	**c,e,g**
4.0	To realize the ideas/ways involving in the processing of solid waste	**4.1**	Identify the purpose of waste processing and explain the processing techniques for reducing the volume and size of wastes.	**a,e**
5.0	To know the impact of waste processing various options for disposal of wastes.	**5.1**	Evaluate the various options for disposal of wastes and their selection criteria.	**e,i,k,l**

UNIT I - SOURCES AND TYPES	**(8)**
Sources and types of municipal solid wastes - waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes - Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules - integrated management-Public awareness; Role of NGO"s.	
UNIT II - COLLECTION AND TRANSFER	**(8)**
Methods of Residential and commercial waste collection – Collection vehicles – Manpower– Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Modern tools for collection and transfer systems.	
UNIT III - ON-SITE STORAGE AND PROCESSING	**(8)**
On-site storage methods - Effect of storage, materials used for containers - segregation of solid wastes - Public health and economic aspects of open storage – waste segregation and storage - case studies under Indian conditions - source reduction of waste - Reduction, Reuse and Recycling.	
UNIT IV - OFF-SITE PROCESSING	**(12)**
Objectives of waste processing - Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options - case studies under Indian conditions.	
UNIT V - DISPOSAL	**(9)**
Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills - Landfill liners - Management of leachate and landfill gas - Landfill bioreactor - Dumpsite Rehabilitation.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. George Tchobanoglous, “Integrated Solid Waste Management”, McGraw Hill Publishers, 2003.
2. Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw Hill, New York, 2004.
3. Vesilind, P.A. and Rimer, A.E., “Unit Operations in Resource Recovery Engineering”, Prentice Hall, Inc., 1981
4. Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, 2000

REFERENCES:

1. Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2000.
2. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
3. Manser A.G.R. and Keeling A.A.," Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996
4. George Tchobanoglous and Frank Kreith"Handbook of Solid Waste Management", McGraw Hill, New York, 2002

17CEX13 – REPAIR AND REHABILITATION OF STRUCTURES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To get the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.	**1.1**	Identify the maintenance and assessment method of distressed structures	**c,d**
2.0	To Recognize deterioration of concrete buildings.	**2.1**	Understand the strength and durability properties ,their effects due to climate and temperature.	**b,c,e**
3.0	To Know Deficiencies in various forms of steel constructions.	**3.1**	Know about recent development in concrete	**c,e,l**
4.0	To Aware of Strengthening techniques for prevailing structures.	**4.1**	Learn the techniques for repair rand protection methods	**c,d,e,l**
5.0	To Compare of verities of rehabilitation techniques according to requirement.	**5.1**	Study about repair,rehabilitation and retrofitting of structures and demolition methods.	**b,c,g,l**

UNIT I - MAINTENANCE AND REPAIR STRATEGIES	**(9)**
Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration	
UNIT II - SERVICEABILITY AND DURABILITY OF CONCRETE	**(11)**
Concrete properties - strength, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion – design and construction errors - Effects of cover thickness and cracking & IS Code Book for Cover thickness.	
UNIT III - MATERIALS FOR REPAIR	**(9)**
Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.	
UNIT IV - TECHNIQUES FOR REPAIR AND DEMOLITION	**(8)**
Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidate structures - case studies.	
UNIT V - REPAIRS, REHABILITATION AND RETROFITTING OF STRUCTURES	**(8)**
Repairs to overcome low member strength, Test on Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Guha, P.K, “Maintenance and Repairs of Buildings”, New Central Book Agency (P) Ltd, Calcutta, 2011
2. R.T.Allen and S.C.Edwards, “Repair of Concrete Structures”, Blakie and Sons, UK, 1987.

REFERENCES:

1. M.S.Shetty, “Concrete Technology” Theory and Practice, S.Chand and Company, New Delhi, 2010.
2. Santhakumar, A.R., “Training Course notes on Damage Assessment and repair in Low Cost Housing” "RHDC-NBO" Anna University, 1992.
3. Raikar, R.N., Learning from failures - Deficiencies in Design, Construction and Service - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. Lakshmipathy, M. Lecture Notes of Workshop on "Repairs and Rehabilitation of Structures", 29th - 30th October 1999.

17CEX14 – DISASTER MANAGEMENT AND MITIGATION					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To provide an exposure to disasters, their significance and types	**1.1**	Identify the principles and components of disaster management	**c,d,e,l**
2.0	To create an awareness on risk assessment and mitigation.	**2.1**	Acquire the knowledge man-made disasters and their issues	**b,d,g**
3.0	To understand the knowledge of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.	**3.1**	Highlight the remote sensing technologies related to disaster management.	**d,e,g**
4.0	To gain a preliminary understanding of approaches of Disaster Risk Reduction	**4.1**	Learn the concepts of risk assessment and mitigation	**c,d,l**
5.0	To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity	**5.1**	Analyse the risk and vulnerability in disaster management	**c,d,e**

UNIT I - NATURAL DISASTERS	**(9)**
Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche.	
UNIT II - MANMADE DISASTERS	**(9)**
Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster.- Forest Fire-Oil fire - accident in Mines.	
UNIT III - GEOSPATIAL TECHNOLOGY	**(9)**
Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping.	
UNIT IV - RISK ASSESSMENT AND MITIGATION	**(9)**
Hazards, Risks and Vulnerabilities. - Disasters in India ,Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building - Preparation of Disaster Management Plans.	
UNIT V - DISASTER MANAGEMENT	**(9)**
Legislative responsibilities of disaster management - Disaster management act 2005- post disaster recovery & rehabilitation, Relief and Logistics Management; disaster related infrastructure development - Post Disaster, Emergency Support Functions and their coordination mechanism.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Ramana Murthy, - Disaster Management, Dominant, New Delhi, 2004.
2. RajdeepDasgupta, Disaster Management and Rehabilitation, Mittal Publishers, New Delhi, 2007.

REFERENCES:

1. Disaster Management in India- A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.2004.
2. Murthy D B N, - Disaster Management: Text and Case Studies, Deep and Deep Publications (P) Ltd., New Delhi, 2007.
3. Sundar I and Sezhiyan T, - Disaster Management, Sarup and Sons, New Delhi, 2007.
4. Khanna B K, - All You Wanted To Know About Disasters, New India Publishing Agency, New Delhi, 2005.

17CEX15 – ENVIRONMENTAL IMPACT ASSESSMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart knowledge on Environmental management and Environmental Impact Assessment.	**1.1**	Carry out scoping and screening of developmental projects for environmental and social assessments by EIA	**c,g**
2.0	To introduce the relevant legal systems and to examine the processes by which normative rules are adopted and enforced	**2.1**	Explain different methodologies which are used at different stages in EIA process	**b,g**
3.0	To develop an understanding of the use of EIA procedures and methods in the project within the planning cycle to promote more sustainable forms of development	**3.1**	Evaluate environmental prediction and assessment reports	**b,c,j**
4.0	To promote more effective use of Environmental Management Systems and implementation of Environmental requirements.	**4.1**	Develop on Environmental Management Systems.	**b,d,h,l**
5.0	To study the practical difficulties through field visit	**5.1**	Study on EIA for infrastructure projects	**b,k**

UNIT I - INTRODUCTION	**(9)**
Impact of development projects - Sustainable development - Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) - EIA capability and limitations - Legal provisions on EIA - Stages of EIA and Types of EIA.	
UNIT II - METHODOLOGIES	**(9)**
Methods of EIA - Check lists - Matrices - Networks - Cost-benefit analysis - Analysis of alternatives	
UNIT III - PREDICTION AND ASSESSMENT	**(9)**
Assessment of Impact on land, water, air, social and cultural activities and on flora and fauna- Mathematical models - Public participation.	
UNIT IV - ENVIRONMENTAL MANAGEMENT PLAN	**(9)**
Plan for mitigation of adverse impact on environment - Options for mitigation of impact on water, air, land on flora & fauna - Addressing the issues related to the Project Affected People. Post project monitoring- Environmental Auditing	
UNIT V - CASE STUDIES	**(9)**
EIA for infrastructure projects - Dams - Highways - Multi-storey Buildings - Water Supply and Drainage Projects - Waste water treatment plants and STP.	
	TOTAL(L: 45) = 45 PERIODS

TEXT BOOKS:

1. Canter, R.L., "Environmental Impact Assessment", McGraw Hill Inc, New Delhi, 2006.
2. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992

REFERENCES:

1. John G. Rau and David C Hooten "Environmental Impact Analysis Handbook", Tata McGraw Hill Book Company, 2000.
2. "Environmental Assessment Source book", Vol. I, II& III. The World Bank, Washington, D.C, 1991.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II" Blackwell Science, 1999.

17CEX16 – CORROSION AND ITS CONTROL				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN : TYPE-3

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To know the forms of corrosion, its forms and protection methods.	1.1	Know the classification of corrosion and its effects	b,g,l
2.0	To study about the principle, types and mechanism of corrosion and protective coatings.	2.1	Study the forms of corrosion	g,l
3.0	To undersatand the purpose of corrosion destiny	3.1	Identify the measuring and exposure techniques	b,c,e,l
4.0	To learn the protection methods for corrosion	4.1	Carry out the protection methods	b,k,l
5.0	To understand the preventive measures in corrosion	5.1	Identify the structural corrosion	k,l

UNIT I - INTRODUCTION	(9)
Corrosion - Theoretical Background - Corrosion Damage - Classification - Principals - Electrochemical aspects - Polarization - passivity - Environmental effects - Effects of oxygen, oxidizers, velocity, Temperature - Corrosive Concentration - Galvanic compiling - inspection	
UNIT II - FORM OF CORROSION	**(9)**
Galvanic corrosion - Creative corrosion pitting - Intergranular corrosion - Selective leaching - Erosion Corrosion - Stress Corrosion - Hydrogen Damage.	
UNIT III - CORROSION DESTINY	**(9)**
Clarification - Purpose - Specimens - Surface Preparation - Measuring and washing - Exposure Technique - Duration - Planned - Internal tests - Aeration - Temperature - Corrosion Rate - NACE test methods - Slav Strain Rosette.	
UNIT IV - CORROSION PROTECTION	**(9)**
Corrosion inhibitors - Electroplated coatings - Conversion coatings - Anodizing - Hot dipping - Sprayed metal coatings - Zinc coating - Alloying - Powder coating - Composite materials in Corrosion management - Electrical methods - Thermal sprayed coatings - Halogen corrosion challemyl.	
UNIT V - STRUCTURAL CORROSION	**(9)**
Corrosion of reinforcement in concrete - Factors influencing corrosion - Damages caused by corrosion - Preventive measures in constructions - tests for existing structures - Remedial measures - Corrosion Analyzer.	
	TOTAL(L: 45) = 45 PERIODS

TEXT BOOK:

1. Mars.G. Fontana, “Corrosion Engineering”, Mc Graw Hill International, 2005.

REFERENCES:

1. Corrosion Hand Book, Electro Chemical Society of India, 2001.
2. A.R. Santhakumar, Concrete Technology, Oxford University. 2007

17CEX17 – ADVANCED SURVEYING TECHNIQUES			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN : TYPE-3

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To study the basic principles and methods of hydrographic surveying.	**1.1**	Apply the right method in locating and plotting of soundings.	**c,k,l**
2.0	To get introduced to the concept of astronomy in locating a celestial body.	**2.1**	Locate a celestial body using different co-ordinate systems in astronomical surveying.	**a,b,c,k,l**
3.0	To impart knowledge on the basics of aerial photogrammetry.	**3.1**	Interpret and scale aerial photographs	**a,c,e,l**
4.0	To learn on the principles of Electronic distance measurements, Total station and GPS.	**4.1**	Apply total station and EDM in distance measurement and traversing.	**a,b,l**
5.0	To give exposure to advanced surveying techniques involved such as remote sensing, GIS, etc	**5.1**	Adopt advanced surveying techniques over conventional methods in the field of civil engineering	**a,d,l**

UNIT I - HYDROGRAPHIC SURVEYING	**(9)**
Shore line survey - River survey - Sounding - Gauges & Equipment - Sounding Rods and Lead Lines - Sounding Chain and lead- Sounding Machine, Fathometers, Signals, Sextants - Methods of sounding - Location of soundings - Plotting of sounding-The Three point problem - Mechanical, Graphical& Analytical methods.	
UNIT II - ASTRONOMICAL SURVEYING	**(9)**
Celestial sphere - astronomical terms and definitions - motion of sun and stars - apparent altitude and corrections - celestial co-ordinate systems - spherical trigonometry - latitude and longitude of a place - field observations and calculations for azimuth- Nautical almanac.	
UNIT III - AERIAL PHOTOGRAMMETRY	**(9)**
Photogrammetry - Types and geometry of aerial photograph- Photographic scale- Flying heights and altitude- Relief and tilt displacement - corrections - Flight Planning - Layout of Photography.	
UNIT IV - EDM, TOTAL STATION AND GPS SURVEYING	**(9)**
Electromagnetic distance measurement (EDM) - principle - types - Total station - working principle, GPS Basics - system overview - Working principle of GPS - Satellite ranging - Calculating position - GPS Survey - Types - Kinematic and static survey techniques.	
UNIT V - BASICS OF REMOTE SENSING AND GIS	**(9)**
Introduction - Historical Background - Electromagnetic Radiation (EMR) - Electromagnetic Spectrum -. Airborne Platforms-Sensors – Types - optical Remote Sensing, Microwave remote sensing - Applications of Remote sensing - LIDAR,GIS-History of Development - Components of GIS - Data models - Raster and Vector data structures - Advanced applications of GIS.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Satheesh Gopi, “Advanced Surveying”, Pearson Education, 2007
2. Kanetkar T.P., “Surveying and Levelling”, Vols. I and II, Standard Publishers, New Delhi 2008
3. SatheeshGopi, “The Global Positioning System and Surveying using GPS”, Tata McGraw, 2005.

REFERENCES:

1. Bannister A and Raymond S, “Surveying”, Addison Wesley Longman ltd, England, 2006.
2. Bossler, J.D., “Manual of Geospatial Science and Technology”, Taylor and Francis, 2002.
3. Burrough, P.A. and McDonnell, R.A., “Principles of Geographic Information System”, Oxford University Press, 2000.
4. Duggal R.K, “Surveying” Vol. I and II, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.

17CEX18 – DIGITAL CADASTRE					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To introduce the students to the cadastral survey Methods and its applications in generation of Land information system.	**1.1**	Gain knowledge about cadastral survey.		**a,e,g,l**
2.0	To execute recording the land rights systematically	**2.1**	Understand the methods of cadastral survey.		**a,b,g**
3.0	To produce register of land holdings or an inventory of land areas, land use and determine land tax.	**3.1**	Get the knowledge about photogrammetric methods.		**a,b,g**
4.0	To study about map projection and processes	**4.1**	Understand Land Record System and computational procedure for modernization of the same.		**c,e,g,l**
5.0	To know about maintenance and measurement of cadastral	**5.1**	Understand the Government procedure in Land Record Management		**a,b,e,l**

UNIT I - INTRODUCTION	**(9)**
History of cadastral survey - Types of survey - Tax - Real Property – Legal cadastre -Graphical and Numerical Cadastre, Legal Characteristics of Records, Torrens System.	
UNIT II - CADASTRAL SURVEY METHODS	**(9)**
Steps in survey of a village - Instruments used for cadastral survey & mapping - Orthogonal, Polar survey methods - Boundary survey - Rectangulation - Calculation of area of Land- GPS and Total Station in Cadastral survey.	
UNIT III - PHOTOGRAMMETRIC METHODS	**(9)**
Photogrammetry for cadastral surveying and mapping - Orthophoto map – Quality control measures - Organisation of cadastral offices – international scenario.	
UNIT IV - CADASTRAL MAPPING AND LIS	**(9)**
Cadastral map reproduction - Map projection for cadastral maps – Conventional symbols - map - reproduction processes - Automated cadastral map, Management of Digital Cadastral. Creation of Land Information System. Integrating LIS –Land administration.	
UNIT V - MAINTENANCE AND MEASUREMENTS	**(9)**
Cadastral survey maintenance - Resurveys - Measurement of sub-division - Measurement of obstructed lines - Survey of urban areas - Control requirement for Urban survey use of Satellite Imagery in boundary fixing.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Paul. R Wolf., Bon A. DeWitt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th ed., 2014
2. R.Subramanian, Surveying and Levelling, Oxford University Press, 2nd ed., 2012

REFERENCES:

1. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co. 2nd ed., 2007.
2. E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.
3. James, M. Anderson and Edward N. Mikhail, Introduction to Surveying, McGraw Hill Book Co, 1985.

17CEX19 – GEOINFORMATICS APPLICATIONS FOR CIVIL ENGINEERS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To solve the Civil Engineering problems with the help of Geoinformatics technique	**1.1**	Get knowledge about the land resource management	**c,d**
2.0	To learn the deformation structural studies	**2.1**	Study structural deformation and movement	**c,d**
3.0	To understand the modeling soil characteristics using satellite data	**3.1**	Model soil characteristics, soil degradation assessment and management.	**a,bl**
4.0	To get the transportation databases for analysis	**4.1**	Monitor urban growth and management of transport infrastructure	**g,i**
5.0	To study about water resources planning and management	**5.1**	Model catchments and management of water resources	**a,e**

UNIT I - LAND RESOURCE MANAGEMENT	**(6)**
Total Station and GPS Surveys – Topographic and Bathymetric Surveys – Cadastral Information – Soil and Land Use Surveys - Land Information System (LIS) – Real Estate Information System	
UNIT II - STRUCTURAL STUDIES	**(6)**
Deformation studies of deflection - Dam deformation - structural movement - Pavement yield - shifting sand-bank and shoreline – Landslide Risk Analysis	
UNIT III - SOIL CONSERVATION AND MANAGEMENT	**(9)**
Soil survey interpretation and mapping - impact of agricultural and industrial activity on soil properties - soil erosion - factors influencing soil erosion - soil contamination using Hyper spectral Remote Sensing - mining pollution- EMR responses with contaminated soil - modeling soil characteristics using satellite data - soil degradation assessment using Remote Sensing and GIS - Land reclamation studies	
UNIT IV - URBAN AND TRANSPORTATION MANAGEMENT	**(12)**
Monitoring Urban Growth through Remote Sensing - Geo-demographic Analysis – Property Market Analysis Urban Renewal - traffic analysis - accident analysis - site suitability analysis for transport infrastructure –transportation databases: creation and maintenance - Vehicle routing – Highway maintenance system – Intelligent Transportation System	
UNIT V -WATER RESOURCES PLANNING AND MANAGEMENT	**(12)**
Location of storage / diversion works – capacity curve generation – sediment yield - modelling of catchments – Delineation of watershed - Watershed modelling for sustainable development - Rainfall – Runoff modelling –LiDAR Mapping for Urban area –Water quality mapping and monitoring – Flood Risk Zoning - Flood damage assessment – Flood Modelling - Assessment of droughts and mitigation	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Basudeb Bhatta, 'Remote Sensing and GIS', Second edition, Oxford University Press 2011.
2. Lo.C.P., Albert K.W.Yeung, Concepts and Techniques of Geographic Information Systems, 2nd ed., PHI Learning Private Limited, Delhi, 2014

REFERENCES:

1. Andrew N. Rencz, Manual of Remote Sensing: Remote Sensing for Natural Resource Management and Environmental Monitoring, John Wiley & Sons Inc, April 2004
2. Rashed, Tarek; Jürgens, Carsten (Eds.), Remote Sensing of Urban and Suburban Areas, Springer, 1st ed., 2010.
3. Harvey J. Miller, Shih-Lung Shaw," Geographic Information Systems for Transportation – Principles and Applications", Oxford University Press, 2001.
4. Gert A. Schulitz Edwin T. Engman, Remote Sensing in hydrology and Water Management, Springer - verlag Berlin Heidelberg Germany - 2000.

17CEX20 – PAVEMENT ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE- 4**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To gains knowledge on various IRC guidelines for designing rigid and flexible pavements.	**1.1**	Get knowledge about types of rigid and flexible pavements.		**a,b,l**
2.0	To study about the flexible pavement design and specification	**2.1**	Able to design of flexible pavements.		**a,b,c,d,l**
3.0	To study about the factors and design procedure for pavement	**3.1**	Able to design of rigid pavements.		**a,b,c,d,l**
4.0	To get exposure on evaluation and maintenance of pavement	**4.1**	Determine the causes of distress in rigid and flexible pavements		**b,c,g**
5.0	To obtain information on stabilisation with special reference to highway pavements	**5.1**	Understand stabilisation of pavements, testing and field control		**a,b,c,e,l**

UNIT I - PAVEMENT AND STRESS DISTRIBUTION ON LAYERED SYSTEM	**(8)**
Introduction – Pavement as layered structure – Pavement types rigid and flexible. Resilient modulus - Stress and deflections in pavements under repeated loading.	
UNIT II - DESIGN OF FLEXIBLE PAVEMENTS	**(10)**
Flexible pavement design Factors influencing design of flexible pavement, Empirical – Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.	
UNIT III - DESIGN OF RIGID PAVEMENTS	**(9)**
Cement concrete pavements , Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.	
UNIT IV - PERFORMANCE EVALUATION AND MAINTENANCE	**(10)**
Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).	
UNIT V - STABILIZATION OF PAVEMENTS	**(8)**
Stabilisation with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilisation for rural roads in India – Use of Geosynthetics in roads.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, "Highway Engineering", Revised 10th edition, New Chand and Brothers, Roorkee 2014.
2. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna tech. Publications, New Delhi, 2005.

REFERENCES:

1. Yoder, R.J. and Witchak M.W. “Principles of Pavement Design”, John Wiley 2000.
2. Guidelines for the Design of Flexible Pavements, IRC-37–2001,The Indian Roads Congress, New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian Road Congress, New Delhi.

17CEX21 – PRESTRESSED CONCRETE STRUCTURES [IS 1343 code book is to be permitted]				
L	T	P	C	
3	0	0	3	
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE-4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To introduce the need for prestressing in a structure and it's advantages	**1.1**	Selection of various methods of prestressing.	**c,d,**
2.0	To introduce the effect of prestressing in the flexural and shear behaviour of structural elements.	**2.1**	Apply the design codes relevant to the design of prestressed concrete structures.	**a,b,c,e, h,l**
3.0	To study about defection and anchorage zone by various method	**3.1**	Design for deflection and crack control of prestressed concrete structures.	**a,b,c,l**
4.0	To understand the concept of composite beams	**4.1**	Analysis and design of composite beam construction	**a,b,c,d, f,h,j,l**
5.0	To study about Merits and demerits of partial prestressing	**5.1**	Design of various prestressed concrete members	**a,b,c,d, e,h,l**

UNIT I - INTRODUCTION – THEORY AND BEHAVIOUR	**(9)**
Basic Principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel Blaton, Lee Mac Call anchorage systems- Analysis of sections for stresses by stress concept, Strength concept and load balancing concept, Loss of Prestress.	
UNIT II - DESIGN FOR FLEXURE AND SHEAR	**(9)**
Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete as per IS1343 Code – Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for strength as per IS 1343 Code – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams –Design for shear based on IS 1343 Code, Layout of Cables.	
UNIT III - DEFLECTION AND DESIGN OF ANCHORAGE ZONE	**(9)**
Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS1343 code – design of anchorage zone reinforcement.	
UNIT IV - COMPOSITE BEAMS AND CONTINUOUS BEAMS	**(9)**
Analysis and design of composite beams – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.	

UNIT V- THEORY OF MISCELLANEOUS STRUCTURES	(9)
Pipes– Partial prestressing – Definition, methods of achieving partial prestressing, Merits and demerits of partial prestressing	
	TOTAL(L: 45) = 45 PERIODS

TEXT BOOKS:

1. Krishna Raju N., "Prestressed Concrete", 5th edition., Tata McGraw Hill Company, New Delhi, 2012
2. Pandit G.S. and Gupta S.P. "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, New Delhi, 2012.

REFERENCES:

1. Dayaratnam.P, "Prestressed Concrete Structures", Oxford and IBH, Bangalore, 2013.
2. Lin T.Y. and Ned.H.Burns, "Design of Prestressed Concrete Structures", 3rd edition., Wiley India Pvt.Ltd. New Delhi, 2013.
3. IS 1343:2012, Code of Practice for Prestressed Concrete Structures, Bureau of Indian Standards, New Delhi.

17CEX22 – COMPUTER AIDED DESIGN OF STRUCTURES					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand the design process based on software.	**1.1**	Understand the concepts of Computer-Aided Design, Software requirements and Hardware components in CAD system.	**e,j,l**
2.0	To study about the wire frame modelling and solid modelling.	**2.1**	Acquire the knowledge in Computer Graphics and Graphics standard.	**b,e,l**
3.0	To understand the concept of FEA and stiffness matrix formulation	**3.1**	Understand the fundamentals of finite element analysis and be able use software for modeling, analysis and design of structures.	**b,c,f**
4.0	To understand about the optimization techniques	**4.1**	Understand the concepts of Optimization techniques and its practical applications to Civil Engineering.	**e,g**
5.0	To study about the artificial intelligence systems	**5.1**	Acquire the knowledge in Artificial Intelligence and Knowledge based expert systems.	**c.d,e**

UNIT I - INTRODUCTION	**(9)**
Fundamental reason for implementing CAD - Software requirements – Hardware components in CAD system – Design process - Applications and benefits.	
UNIT II - COMPUTER GRAPHICS	**(9)**
Graphic Software - Graphic primitives - Transformations - 2D & 3D transformations - Concatenation - Wire frame modeling - Solid modeling - Graphic standards - Drafting packages.	
UNIT III - STRUCTURAL ANALYSIS	**(9)**
Principles of structural analysis - Fundamentals of finite element analysis - Concepts of finite elements - Stiffness matrix formulation - Variational Method - Weighted residual method - Problems - Convergence criteria - Analysis packages and applications.	
UNIT IV - DESIGN AND OPTIMIZATION	**(9)**
Principles and design of steel, RC structures - Beams and Columns - Applications to simple design problems - Optimization techniques - Algorithms - Linear programming - Simplex Method	
UNIT V - EXPERT SYSTEMS	**(9)**
Introduction to artificial intelligence - Knowledge based expert systems and Applications - Rules and decision tables - Inference mechanisms - simple applications	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Groover M.P. and Zimmers E.W. Jr., "CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India Ltd, New Delhi, 1993.
2. Krishnamoorthy C.S.Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi, 2001

REFERENCES:

1. Harrison H.B., "Structural Analysis and Design", Part I and II Pergamon Press, Oxford,1990.
2. Rao S.S., "Optimisation Theory and Applications", Wiley Eastern Limited, New Delhi, 1984.
3. Richard Forsyth (Ed), "Expert System Principles and Case Studies", Chapman and Hall, London, 1989.

17CEX23 – PREFABRICATED STRUCTURES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-4**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To explain the basic principles involved in prefabrication	**1.1**	Apply the principles and systems of prefabrication in the field.		**c,e**
2.0	To study the behavior of structural Components	**2.1**	Identify suitable prefabricated components for specific use.		**c,e,l**
3.0	To impart knowledge on prefabricated elements and the technologies used for fabrication and erection	**3.1**	Understand the design principles of fabrication		**b,d,e,l**
4.0	To impart knowledge on the applications of prefabricated elements in construction	**4.1**	Classify the structural connections		**c,e,g**
5.0	To gain knowledge about the modern trends in building construction, role of prefabricated structures and the basic functional requirements of industrial structures.	**5.1**	Utilize the various code provisions regarding progressive collapse.		**c,e,l**

UNIT I - INTRODUCTION	**(9)**
Need for prefabrication – Principles of prefabrication – Modular coordination – Standarization – Materials – Systems – Production – Transportation – Erection.	
UNIT II - PREFABRICATED COMPONENTS	**(9)**
Behaviour and types of structural components – Large panel systems – roof and floor slabs – Walls panels - Beams - Columns - Shear walls.	
UNIT III - DESIGN PRINCIPLES	**(9)**
Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems.	
UNIT IV - JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS	**(9)**
Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction, contraction, expansion. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation	
UNIT V - DESIGN FOR ABNORMAL LOADS	**(9)**
Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. L. Mokk, Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991.
3. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage", Applied Science Publishers , London And New Jersey, 1982.
4. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2011

REFERENCES:

1. B. Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam, London, New York, 1998
2. Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
3. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009

17CEX24 – BASICS OF DYNAMICS AND ASEISMIC DESIGN [IS 1893, IS 13920 and IS 4326 Code Books are to be Permitted]					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE- 4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To introduce dynamic loading and the dynamic performance of the structures.	**1.1**	Assess the influence of vibrations and selection of remediation methods based on the nature of vibration	**a,b,d,l**
2.0	To discuss different types of dynamic loading.	**2.1**	Understand the dynamic concepts of MDOF systems	**b,c,e**
3.0	To study on the performance of structures under earthquake loading.	**3.1**	Realize the origin, various terminologies and behavior of earthquakes	**a,c,f,g,l**
4.0	Understand the codal provisions to design the structures as earthquake resistant.	**4.1**	Analyse and design the structures for earthquake forces as per IS 1893 and IS 13920.	**a,d,f,l**
5.0	Study about the earthquake design concepts and it's control measures.	**5.1**	Know the control measures as well as the Aseismic design methodology	**d,e,l**

UNIT I - THEORY OF VIBRATIONS	**(9)**
Theory of vibrations and harmonic motion - Dynamic Loads - D'Alembert's Principle and inertia forces - Degree of freedom - Equation of motion for SDOF - Damped and Undamped free vibrations - Undamped forced vibration - Natural frequencies	
UNIT II - MULTIPLE DEGREE OF FREEDOM SYSTEM	**(9)**
Two degree of freedom system - Normal modes of vibration - Natural frequencies - Mode shapes - Introduction to MDOF systems -Decoupling of equations of motion - Concept of mode superposition (No derivations).	
UNIT III - ENGINEERING SEISMOLOGY	**(9)**
Elements of Seismology - Causes of Earthquakes -Seismic waves - Magnitude &Intensity of earthquake, Seismogram- Case studies on past earthquakes- Seismic zone maps of India - Strong motion characteristics.	
UNIT IV - DESIGN METHODOLOGY	**(9)**
IS 1893-Codal provisions - Design horizontal seismic coefficient - Design base shear distribution, IS 13920 and IS 4326 - Codal provisions, Effect of soil properties and damping -liquefaction Types, effects and controlling factors	
UNIT V - EARTHQUAKE RESISTANT DESIGN	**(9)**
Principles of Earthquake Resistant Design - Response spectrum theory and Design spectra-Time Acceleration method, Base isolation techniques - Vibration control measures - Important points in mitigating effects of earthquake on structure	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. A K. Chopra, "Dynamics of Structures – Theory and Applications to Earthquake Engineering", Printice-Hall India Pvt Ltd, 4th ed., 2003.
2. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2006.

REFERENCES:

1. Mario Paz, "Structural Dynamics – Theory and Computation", CBS Publications, 2nd ed., 2004.
2. IS 1893 - 2002, Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi
3. IS 4326 - 2013, Earthquake Resistant Design and Construction of Buildings – Code of Practice, BIS, New Delhi
4. IS 13920 - 2016, Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice, BIS, New Delhi.

17CEX25 – PRINCIPLES OF COMPUTATIONAL FLUID DYNAMICS			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN : TYPE -3

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand the basic concepts in turbulence modelling.	1.1	Develop knowledge on non linear problems	a,l
2.0	To provide fundamental knowledge on finite difference/ element and volume methods.	2.1	Improve knowledge on finite element, difference and volume methods.	a,b,l
3.0	To describe the solution methodologies for discretized equations.	3.1	Provide solution methodologies for real time problems.	a,b,e
4.0	To give knowledge on methods of fluid flow	4.1	Analyse the fluid flow using coupling equations.	a,b,l
5.0	To develop models using structured and unstructured grids.	5.1	Develop hydrological and hydrodynamic models.	d,e

UNIT I - INTRODUCTION	(9)
Derivation of flow governing equations; turbulence modeling; modeling approaches for multiphase flow; initial and boundary conditions; wellposedness.	
UNIT II - PRINCIPLES OF SOLUTION OF THE GOVERNING EQUATIONS	**(9)**
Discretization of the governing equations using finite difference / volume / element methods; concepts of consistency, stability and convergence; template for the discretization of a generic unsteady transport equation.	
UNIT III - FUNDAMENTALS OF DISCRETIZATION	**(9)**
Solution of discretized equations; direct methods; classical iterative methods; advanced methods for structured matrices; conjugate gradient techniques; multigrid methods.	
UNIT IV – FLUID FLOW	**(9)**
Solution of coupled equations: methods for compressible flows; evaluation of pressure in incompressible flows; pressure - velocity coupling algorithms.	
UNIT V - GRID GENERATION	**(9)**
Structured and unstructured grids; structured grid generation; unstructured grid generation. Benchmarking; calibration.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Pieter Wesseling, “Principles of Computational Fluid Dynamics”,Springer series, 2009
2. John D Anderson Jr, “Computational Fluid Dynamics - The Basics with Applications”, 1st ed., McGraw Hill Education (India) Private Limited, 2012

REFERENCES:

1. Anil W. Date, “Introduction to Computational Fluid Dynamics”, Cambridge, 2005
2. Charles Hisch, “Numerical computation of internal and external flows”, Elsevier, 2007
3. Oleg Zikanov, “Essential Computational Fluid Dynamics”, Wiley India Pvt Ltd, 2012

17GEA02 – PRINCIPLES OF MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE – 3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To study the importance and functions of management in an organization.	**1.1**	Acquire comprehensive knowledge on management concepts.	**g, h, i**
2.0	To study the importance of planning and also the different types of plan.	**2.1**	Understand and apply planning concepts at different conditions and situations.	**c, d, g, i**
3.0	To understand the different types of organization structure in management	**3.1**	Accomplish organizational structures and understand the staffing process.	**c. d, f, i**
4.0	To understand the basis and importance of directing in management	**4.1**	Motivate employees and project managements in working environments.	**d, f, j, k**
5.0	To understand the importance of control techniques	**5.1**	Do the budgetary and non-budgetary control of projects.	**c, e, g, k**

UNIT I - OVERVIEW OF MANAGEMENT	**(9)**
Definition of management – Science & Art – Management & Administration - Role of managers – Evolution of Management thoughts – Contribution of Taylor and Fayol – Functions of management – Strategies for International business.	
UNIT II - PLANNING	**(9)**
Nature and purpose of planning - Planning process - Types of plans – Objectives – Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.	
UNIT III - ORGANIZING	**(9)**
Nature and purpose of organizing - Organization structure - Formal and informal organization - Line and Staff authority- Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing – Selection and Recruitment - Orientation -Career Development - Career stages – Training - Performance Appraisal.	
UNIT IV - DIRECTING	**(9)**
Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership – Types of Leadership – Job enrichment - Communication - hurdles to effective communication – Organization Culture - Elements and types of culture - Managing cultural diversity.	
UNIT V - CONTROLLING	**(9)**
System and Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control – Quality Control - Planning operations.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. Harold Koontz, Heinz Weihrich , “Essentials of Management”, Tata McGrawHill, 8th ed., Second Reprint 2010.

REFERENCES:

1. Andrew J. Dubrin, "Essentials of Management", Thomson Southwestern, 9th ed., 2012.
2. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall of India, 10th ed., 2010.
3. Charles W L Hill, Steven L Mc Shane, "Principles of Management", Mc Graw Hill Education, Special Indian Edition, 2008.
4. Hellriegel, Slocum & Jackson, "Management - A Competency Based Approach", Thomson South Western, 10th ed., 2007.
5. Harold Koontz, Heinz Weihrich and Mark V Cannice, "Management - A global & Entrepreneurial Perspective", Tata Mc Graw Hill, 12th ed., 2007.

17GEA03 - TOTAL QUALITY MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PAPER TYPE -3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program outcomes**	
1.0	To acquire various concepts of quality management.	**1.1**	Acquire various concepts of quality management.	**b,c,f**	
2.0	To implement various principles of quality management.	**2.1**	Implement various principles of quality management.	**b,c,f**	
3.0	To impart quality using statistical process.	**3.1**	Impart quality using statistical process.	**b,c,e**	
4.0	To use the various tools to maintain quality.	**4.1**	Learn to use the various tools to maintain quality.	**b,c,e**	
5.0	To implement the quality system for ISO certification.	**5.1**	Implement the quality system for ISO certification.	**b,c,f,h**	

UNIT I – INTRODUCTION	**(9)**
Definitions-Basic approach - Gurus of TQM - TQM Framework - Defining Quality - Dimensions of quality- Benefits of TQM - Leadership: Leadership Concepts - The Deming philosophy - Quality council - Quality statements- Strategic planning- Customer satisfaction: Customer perception of quality - Using customer complaints- service quality- Customer retention.	
UNIT II - TQM PRINCIPLES	**(9)**
Employee involvement: Motivation- Empowerment- Teams- Recognition and Reward- Performance appraisal – Continuous process improvement: The Juran Trilogy - PDSA cycle- Kaizen - Six sigma - Supplier Partnership: Partnering, Supplier selection - Supplier Rating.	
UNIT III- TQM TOOLS AND TECHNIQUES- I	**(9)**
Bench marking - Reason to bench mark, process - Quality Function Development (QFD) - Failure mode and effect analysis - Stages of FMEA - Other types of FMEA - Management tools: Tree diagram - Matrix diagram- Process decision program chart - Activity network diagram.	
UNIT IV - TQM TOOLS AND TECHNIQUES- II	**(9)**
Statistical process control: Pareto diagram - Process flow diagram - Cause and effect diagram - Histogram - Charts - Variable control chart-Control chart for attributes - Scatter diagrams - Process Capability - Total productive maintenance: Learning the new philosophy -Training-Improvement needs.	
UNIT V- QUALITY MANAGEMENT SYSTEMS	**(9)**
Benefits of ISO registration - ISO 9000 series of standards - ISO 9001 Requirements - implementation, Documentation, Internal Audits - Environmental Management system - ISO 14000 series standards - Concepts of ISO 14001- Requirements of ISO 14001 - Benefits of EMS.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, 3rd ed., Indian Reprint, 2011.

REFERENCES :

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th ed., First Indian Edition, Cengage Learning, 2012.
2. Subburaj Ramasamy , “Total Quality Management”, Tata McGrawHill, First reprint 2009.
3. Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

17GEA04 - PROFESSIONAL ETHICS AND HUMAN VALUES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE – 3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program outcomes**
1.0	To understand the theory of engineering ethics.	**1.1**	Know the concepts of ethics and values.		**f, h**
2.0	To enable the students to create an awareness on Engineering Ethics and Human Values.	**2.1**	Acquire the knowledge of interpersonal and organizational issues in ethics		**f, h**
3.0	To instill Moral and Social Values and Loyalty.	**3.1**	Able to Highlight the ethical issues related to engineering.		**f, h, i, l**
4.0	To appreciate the safety, responsibilities and rights of others.	**4.1**	Learn the concepts of engineer's responsibilities and their rights.		**f, h, i, l**
5.0	To understand the role of professional bodies	**5.1**	Understand the role of global issues and professional bodies.		**f, h, i, l**

UNIT I - HUMAN VALUES	**(9)**
Morals, values and Ethics - Integrity - Work ethic - Service learning - Civic virtue - Respect for others - Living peacefully - Caring - Sharing - Honesty - Courage - Valuing time - Cooperation - Commitment - Empathy - Self confidence - Character - Spirituality - Introduction to Yoga and meditation for professional excellence and stress management.	
UNIT II - ENGINEERING ETHICS	**(9)**
Senses of Engineering Ethics - Variety of moral issues - Types of inquiry - Moral dilemmas – Moral Autonomy – Kohlberg's theory - Gilligan theory - Consensus and Controversy - Models of professional roles - Theories about right action - Self-interest - Customs and Religion - Uses of Ethical Theories.	
UNIT III - ENGINEERING AS SOCIAL EXPERIMENTATION	**(9)**
Engineering as Experimentation - Engineers as responsible Experimenters - Codes of Ethics - A Balanced Outlook on Law - The Challenger case study - Bhopal Gas Tragedy and Chernobyl case studies.	
UNIT IV - SAFETY, RESPONSIBILITIES AND RIGHTS	**(9)**
Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) - Discrimination.	
UNIT V - GLOBAL ISSUES	**(9)**
Multinational Corporations - Environmental Ethics - Computer Ethics - Weapons Development – Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Moral Leadership - Code of Conduct - Corporate Social Responsibility.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 4th Edition , Tata Mc Graw Hill, New Delhi, 2014.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India Private Limited, New Delhi, 20012.

REFERENCES:

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2008
4. Web sources: 1. www.onlineethics.org 2. www.nspe.org 3. www.globalethics.org 4. www.ethics.org

17CSX31- PROBLEM SOLVING AND PROGRAMMING					
			L	T	P	C
			3	0	0	3
PREREQUISITE : 17CSC01 / 17CSC02		**QUESTION PATTERN : TYPE 1**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To gain knowledge about the basics of programming	**1.1**	The students will be able to understand the basics of Python Programming constructs.		**a,c,l**
2.0	To gain exposure about selection structure	**2.1**	The students will be able to design programs involving selection structure		**a,b,c,d,l**
3.0	To get knowledge about repetition structure, function and modules	**3.1**	The students will be able to design programs involving function, modules and loops.		**a,b,c,d,k,l**
4.0	To gain exposure about string	**4.1**	The students will be able to realize the need of strings.		**a,b,c,d,k,l**
5.0	To get knowledge about mutable and Immutable types	**5.1**	The students will be able to realize the need of list, tuples and dictionary.		**a,b,c,d,k,l**

UNIT I - INTRODUCTION TO BASICS OF PROGRAMMING	**(9)**
Basics - Variables and Assignment - Basic Data Types- Comments - Operators - print() - Floats	
UNIT II - SELECTION STRUCTURE	**(9)**
Introduction to Selection Structure - if statements, else statements, nested elif statements, truthy and falsey values, Control Structure	
UNIT III - VALUE – REPETITION AND RETURNING STRUCTURE	**(9)**
Loops - while loops, for loops - Nested Loops - Functions - modules - variable scope	
UNIT IV - DATA AND STRING PROCESSING	**(9)**
Strings - Accessing the Strings - Traversing the Strings - Working with Strings - Formatting Strings	
UNIT V - MUTABLE AND IMMUTABLE TYPES AND METHODS	**(9)**
Introduction to lists, indexing and slicing of list, del and list methods, Tuples, Dictionary and its methods.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Dr. R. Nageswara Rao, - Core Python Programming, Dreamtech Press, 2017 Edition.
2. **Reema Thareja - Problem Solving and Programming – Python, Oxford University Press, 2nd Edition.**

REFERENCES:

1. Wesley J. Chun, ―Core Python Programming, Pearson Education, 2nd edition, 2010.

17ITX26- PROBLEM SOLVING AND ALGORITHMIC SKILLS					
		L	T	P	C
		3	0	0	3
PREREQUISITE: NIL		**QUESTION PATTERN : TYPE – 1**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To impart fundamental concepts of OOP using python	**1.1**	The students will be able to understand the basics of object oriented concepts in python.	**a,c,l**	
2.0	To gain exposure about inheritance and polymorphism	**2.1**	The students will be able to develop applications using inheritance and polymorphism	**a,b,c,d,e,k,l**	
3.0	To understand the abstract data types and tree data structures	**3.1**	The students will be able to implement the ADTs and trees	**a,b,c,d,e,k,l**	
4.0	To see how graphs and heaps can be used to solve a wide variety of problems	**4.1**	The students will be able to design graph abstract data type and heap	**a,b,c,d,e,k,l**	
5.0	To understand the sorting techniques and shortest path algorithms.	**5.1**	The students will be able to implement the sorting techniques and shortest path algorithms.	**a,b,c,d,e,k,l**	

UNIT I - MOTIVATION OF FUNDAMENTAL CONCEPT IN PROGRAMMING	**(9)**
Implementation of Classes and Objects in Python - Class Attributes and Instance Attributes - 'self ' parameter - Static Methods and Instance Methods - init() method	
UNIT II - ADVANCED FEATURES IN CONCEPT OF PROGRAMMING	**(9)**
Performing Abstraction and Encapsulation in Python - Single Inheritance - Multiple Inheritance - Multilevel Inheritance - Public, Protected and Private - Naming Conventions. Polymorphism- Overriding and the super() method - Diamond Shape Problem in Multiple Inheritance - Overloading an Operator - Implementing an Abstract Base Class (ABC)	
UNIT III - INTRODUCTION TO ALGORITHMIC THINKING AND PEAK FINDING	**(9)**
Array data structure - Linked List Data Structure and Its Implementation - Stacks and Queues - Binary Search Trees - Balanced Trees: AVL Trees and Red-Black Trees	
UNIT IV - MAPPING VALUES AND PRINCIPLE OF OPTIMALITY	**(9)**
Heaps - Heapsort Algorithm - Associative Arrays and Dictionaries - Ternary Search Trees as Associative Arrays - Basic Graph Algorithms - Breadth - First And Depth - First Search - Spanning Trees	
UNIT V - ANALYZING NUMBER OF EXCHANGES IN CRAZY-SORT	**(9)**
Shortest Path Algorithms, Dijkstra's Algorithm - Bellman-Ford Algorithm - Kruskal Algorithm - Sorting Algorithms- Bubble Sort, Selection Sort and Insertion Sort - Quicksort and Merge Sort, Non-Comparison Based Sorting Algorithms, Counting Sort and Radix Sort	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Dusty Phillips, Python 3 Object-oriented Programming, Packt Publishing, Second Edition.
2. Bradley N. Miller, David L. Ranum,- Problem Solving with Algorithms and Data Structures Using Python, Franklin, Beedle & Associates, 2011.

REFERENCES:

1. Mark Summerfield - Programming in Python 3, Pearson Education, 2nd Edition
2. Michael T. Goodrich, Irvine Roberto Tamassia, Michael H. Goldwasser, - Data Structures and Algorithms in PythonII, 2013 edition.

17CEX26 CONSTRUCTION SAFETY				
L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE-3**

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The Students will be able to	Related Program outcomes
1.0	To recognize reasons of accidents and hazards during progress of construction	1.1	Identify the correct and proper method of managing accidents by analyzing the situation	a,d
2.0	To identify suitable method of safety against construction accidents	2.1	Get trained to choose the appropriate safety programmes at the site	d,l
3.0	To recognize obligations for the duration of contract	3.1	Get acquainted to adopt the contractual obligations which are essential in the site	g,h
4.0	To study the regulations related to health hazards	4.1	Know the hazard assessment procedures and their control	b,d
5.0	To understand the safety technology for the workers	5.1	Implement plan for safety technology for the safety of workers	g,l

UNIT I - CONSTRUCTION ACCIDENTS **(9)**

Accidents and causes - accident prevention - principles of accident prevention - potential hazards/risks associated with construction sites - high risk activities - use of hoists - scaffolding and working at height safety procedure - working in confined space - costs of construction injuries - accident management.

UNIT II - CONSTRUCTION SAFETY PROGRAMMES **(9)**

Introduction - problem areas in construction safety - elements of effective safety programme - job safety analysis - fault free analysis - job-site safety assessment - safety regulations at construction sites - code of practice - human factors in construction safety - construction safety management - safety meetings - safety incentives - safety training - safety policy - safety committees - safety inspection - safety audit.

UNIT III - CONTRACTUAL OBLIGATIONS **(9)**

Government's policy in industrial safety - safety scenario in construction industries - safety and health legislation in India - safety provisions in construction contracts - sub contractual obligation - Workers compensation - substance abuse - safety record keeping.

UNIT IV - OCCUPATIONAL HEALTH PRACTICES **(9)**

Statutory requirements and regulations related to health hazards - Legal implications - dust hazards and control - occupational and safety hazard assessment - Noise assessment and control measures - impact and vibration.

UNIT V - DESIGNING FOR SAFETY **(9)**

Safety culture - safe workers - first line supervisors - middle managers - top management practices - company activities on safety - safety personnel - project coordination and safety procedures - safety technology - principles of risk and loss control - machinery safety - machine guarding - workplace ergonomics including display screen equipment and manual handling - personal protective equipment - first aid and emergency preparedness - fire safety - electrical hazards.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Richard J.Coble, Jimmie Hinze and Theo C. Haupt, “Construction Safety and Health Management”, Prentice Hall of India, New Delhi, 2001
2. Jimmy W. Hinze, “Construction Safety”, Prentice Hall of India, New Delhi, 1997.

REFERENCES:

1. Tamilnadu Factory Act, Department of Inspectorate of factories, Tamilnadu.
2. Koncz T., “Manual of Precast Concrete Construction”, Vol. I, II and III, Bauverlag, GMBH, 1971.
3. Safety, Health and Environment Handbook, published by Director General, CPWD New Delhi, 2019

17CEX27- SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To study about concepts of sustainable materials in construction	1.1	Describe the various sustainable materials used in construction.	e,g,i,l
2.0	To understand the energy calculations for construction materials	2.1	Explain the method of estimating the amount of energy required for building.	e,g,k
3.0	To impart knowledge in green buildings and environmental effects.	3.1	Describe the features of LEED, TERI and GRIHA ratings of buildings.	e,g,j,k,l
4.0	To understand the concepts of lean tools	4.1	Explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity.	g,h,k
5.0	To impart knowledge on lean construction tools and techniques	5.1	Apply lean tools and techniques to achieve sustainability in construction projects.	e,g,k,l

UNIT I - INTRODUCTION AND MATERIALS USED IN SUSTAINABLE CONSTRUCTION	**(9)**
Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.	
UNIT II - ENERGY CALCULATIONS	**(9)**
Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use.	
UNIT III - GREEN BUILDINGS	**(9)**
Control of energy use in building - National Building Code (NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations - Features of LEED and TERI - Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building.	
UNIT IV - CORE CONCEPTS IN LEAN	**(9)**
Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).	
UNIT V - LEAN CONSTRUCTION TOOLS AND TECHNIQUES	**(9)**
Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream / Process Mapping - 5S , Collaborative Planning System (CPS)/ Last Planner™ System (LPS) - Big Room Approach, IT/BIM and Lean, How to Start Practicing Lean Tools in Project Site.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Charles J Kibert, "Sustainable Construction : Green Building Design and Delivery", 4th ed., Wiley Publishers 2016.
2. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., "Lean Construction Tools and Techniques", 2002.

REFERENCES:

1. Steve Goodhew, “Sustainable Construction Process”, Wiley Blackwell,UK, 2016.
2. Craig A. Langston & Grace K.C. Ding, “Sustainable Practices in the Built Environment”, Butterworth Heinemann Publishers, 2011.
3. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., “Site implementation and Assessment of Lean Construction Techniques”, Lean Construction Journal, 2005.

17CEX28 - ENERGY EFFICIENT BUILDINGS					
			L	T	P	C
			3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To create awareness of the necessity of energy needed for structures.	**1.1**	Explain the various energy consumptions pattern.	e,g
2.0	To study the different climate types and their influence in building design	**2.1**	Predict the climate change and environmental factors in building design.	e,f,g
3.0	To study about the Thermal performance in building design	**3.1**	Design buildings according to thermal environment.	e,f,i,k,l
4.0	To learn the energy consumptions in buildings	**4.1**	Identify the utilization of appliances and the principles behind them.	b,c,e
5.0	To understand the concept of energy audit and its applications	**5.1**	Apply the concept of energy audit in buildings.	f,g,h,k

UNIT I - INTRODUCTION	**(9)**
Need of Energy in buildings - assessment - Energy consumption pattern of various types of buildings - Factors influencing the energy use in building - Concepts of energy efficient building	
UNIT II - CLIMATE	**(9)**
Study of climate types - their influence in building design - Environmental factors affecting building design - Analysis of thermal and visual environment. An overview of design concepts of energy efficient buildings for various zones - Cold and cloudy - Cold and sunny - Composite - Hot and dry - Moderate - Warm and humid.	
UNIT III - HEAT AND LIGHT	**(9)**
Heat gain and loss phenomenon in buildings - Thermal performance parameters - Role of building enclosures, openings and materials in thermal environment - Basic principles of light and daylight - Energy efficient light design of buildings - Daylight design of buildings.	
UNIT IV - APPLIANCES IN BUILDINGS	**(9)**
Major appliances in building and their energy consumptions - Principles of solar heating, cooling and power (PV) systems - Integration of energy efficient appliances with the buildings.	
UNIT V - ENERGY AUDIT	**(9)**
Energy survey and energy audit of buildings - Calculation of energy inputs and utilization in buildings - Energy audit reports of buildings - Concepts of Green Buildings - energy rating of buildings.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. LalJayamaha, “Energy - Efficient Building Systems: Green Strategies for Operation and Maintenance”, Tata McGraw Hill, 2007.
2. Krishnan, A., Baker, N., Yannas, S. & Szokolay, S.V., “Climate Responsive Architecture - A Design Hand Book for Energy Efficient Buildings”, Tata McGraw Hill Publishing Company Ltd, Delhi, 2001.

REFERENCES:

1. Chand, I. and Bhargava, P.K., “The Climatic Data Handbook”, Tata McGraw Hill Publishing Company Limited, New Delhi 1999.
2. Threlkeld, J.L, ”Thermal Environmental Engineering”, Prentice-Hall, Englewood Cliffs, NJ, 1998.
3. Energy Conservation Building Code, CAU of Energy Efficiency, New Delhi, 2018.

17CEX29 - MODERN CONSTRUCTION MATERIALS			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To impart knowledge on the properties of special concretes.	**1.1**	Use the special concrete based on the needs in the field.	f,g,l
2.0	To study the application of metals and its alloys.	**2.1**	Employ the correct metal as per prevailing weather conditions.	e,f
3.0	To impart knowledge on the various types of composites.	**3.1**	Select the appropriate composites for panel constructions.	g,i,k
4.0	To get knowledge on new construction materials for waterproofing and insulation.	**4.1**	Choose suitable waterproofing and insulating materials for effective construction.	c,g,l
5.0	To impart knowledge on smart and intelligent materials.	**5.1**	Utilize the state of art of energy efficient and self - healing materials	f,g,l

UNIT I - SPECIAL CONCRETES	**(9)**
Concrete and its behaviours - Properties, advantages and applications - High Strength Concrete - High Performance Concrete - Fiber Reinforced Concrete - Self-Compacting Concrete - Waste-material based concrete - Geopolymer concrete - Materials for fire, thermal, electrical and explosive resistance.	
UNIT II - METALS	**(9)**
Types of Steel - Properties and manufacturing process - Advantages of new alloy steels - Properties and advantages of aluminium and its products - Types of coatings to reinforcement - Applications of coatings - Physical descriptions of asbestos sheets, GI sheets, tubes and light weight roofing materials.	
UNIT III - COMPOSITES	**(9)**
Types of plastics - Properties and manufacturing process - Advantages of reinforced polymers - Types of FRP - FRP on different structural elements - Applications of FRP - Applications of metal, ceramics and polymer matrix composites.	
UNIT IV - SPECIAL MATERIALS	**(9)**
.Types and properties of water proofing compounds - Properties of geo-synthetics and geo-membrane - Conventional and modern insulating materials - Thermal, sound and electrical insulating materials - Materials for 3D printing structures	
UNIT V - SMART AND INTELLIGENT MATERIALS	**(9)**
Smart and intelligent materials - Special features and its types - Piezoelectric material and shape memory alloys - Energy harvesting material - Self healing polymer - Case studies on the applications of smart and intelligent materials - Sensor to detect structural cracks and health of structures.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Shetty M.S, “Concrete Technology: Theory and Practice”, S. Chand & Company Ltd., 2016.
2. Shan Somayaji, “Civil Engineering Materials”, Prentice Hall Inc., 2010.

REFERENCES:

1. ACI Report 440.2R-02, “Guide for the design and construction of Externally Bonded RP systems for Strengthening Concrete Structures”, American Concrete Institute, 2012.
2. Ashby, M.F. and Jones.D.R.H.H. “Engineering Materials 1: An introduction to Properties, applications and designs”, Elsevier Publications, 2015.
3. Mamlouk, M.S. and Zaniewski, J.P., “Materials for Civil and Construction Engineers”, Prentice Hall Inc.,1999

17CEX30 - ADVACED CONSTRUCTION TECHNIQUES				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To impart knowledge on the substructure construction.	**1.1**	Identify the techniques for substructure Constructions.	j,l
2.0	To impart knowledge on the super structure construction.	**2.1**	Choose suitable technique for Super Structure Constructions	e,f,g,l
3.0	To impart knowledge on the special structure construction.	**3.1**	Handle the Special Structure Constructions like. Cooling towers, Offshore structure etc.	f,g,k,l
4.0	To underline and discuss about earthquake resistant buildings	**4.1**	Construct Earthquake Resistant Buildings	g,i,k,l
5.0	To provide understanding of modern construction techniques.	**5.1**	Select Modern Construction Techniques in construction projects.	e,f,g,l

UNIT I - SUBSTRUCTURE CONSTRUCTION	**(9)**
Box jacking- Pipe jacking - Diaphragm walls and basement - Tunneling Techniques - Piling Techniques - Driving well and caisson - Sinking cofferdam - Cable anchoring and grouting - Sheet piles - Offshore system - Shoring - Dewatering techniques.	
UNIT II - SUPER STRUCTURE CONSTRUCTION	**(9)**
Vacuum dewatering - Concrete paving technology - Techniques for continuous concreting in tall buildings - Suspended formwork - Erection techniques of tall structures and large span structures - Launching techniques for heavy decks - In-situ pre-stressing in high rise structures, aerial transporting handling and erecting lightweight components on tall structures.	
UNIT III - SPECIAL STRUCTURE CONSTRUCTION	**(9)**
Erection of lattice towers and transmission line structures - Cooling towers, silos, chimney, sky scrapers and cable stayed bridges - Launching of box decks - Offshore structures - Domes and pre - stress domes - Erection of articulated structures, braced domes and space decks - Spatial structures.	
UNIT IV - EARTHQUAKE RESISTANT BUILDINGS	**(9)**
Planning of earthquake resistant buildings - Construction of walls - Provision of corner reinforcement - Construction of beams and columns - Base isolation	
UNIT V - MODERN CONSTRUCTION TECHNIQUES	**(9)**
Precast Flat Panel System - 3D Volumetric Construction - 3D Printing - Hybrid Concrete Construction - Modular Construction Practices - Modular coordination and Standardization - Modular System Building - Limitation and Advantages	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Jerry Irvine, “Advanced Construction Techniques”, CA Rocketr, 2016.
2. Roger Greeno, Chudley R, Mike Hurst, Simon Topliss, “Advanced Construction Technology”, 5th ed., 2012.

REFERENCES:

1. Allen E, Iano, J, "Fundamentals of Building Construction, Material and Method", John Wiley and Sons, 7th ed., 2019.
2. Cameron K. Andres, Ronald C. Smith, "Principles and Practices of Commercial Construction", 9th ed., Prentice Hall, 2018.
3. Sankar S.K. and Saraswati, S., "Construction Technology", Oxford University, New Delhi, 2018.

17CEX31 - CONSTRUCTION EQUIPMENT MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To impart knowledge on planning and managing the equipment as per the field requirement	**1.1**	Practise in analysing equipment characteristics and planning them effectively.	c,e,g
2.0	To understand equipment types and its operations	**2.1**	Select appropriate equipment with respect to construction works and ground conditions.	e,g,l
3.0	To impart knowledge on procurement of equipments	**3.1**	Explain about construction equipment procurement process.	e,g
4.0	To impart knowledge on the maintenance of equipment.	**4.1**	Employ and practice appropriate techniques for effective equipment maintenance.	d,e,f
5.0	To impart knowledge on the safety of equipment employed in different conditions.	**5.1**	Engage in suitable training and choose correct safety method while handling equipment.	e,h,k,l

UNIT I - PLANNING AND MANAGEMENT OF EQUIPMENT	**(9)**
Importance and role in construction field - Identification - Planning - Replacement - Cost control of equipment - Depreciation analysis - Replacement of equipment - Replacement analysis.	
UNIT II - EQUIPMENTS IN CONSTRUCTION	**(9)**
Types of equipment and operations - Earth moving, pile driving, road construction, concrete placing, materials handling, off-site and on-site fabrication and repair works, mechanical and electrical equipment installation - Tunnelling - Techniques adopted - Performance characteristics related to the jobs in hand.	
UNIT III - EQUIPMENT PROCUREMENT MANAGEMENT	**(9)**
Construction equipment - Purchase Order - Indents - Marketing - Registration of sellers - Selection and placement of Order - Follow up - Physical training - Physical Inspection and verification - fixation of the re-order level - Buying / Leasing / Hiring Option - Owner's tools and Plants	
UNIT IV - EQUIPMENT MAINTENANCE MANAGEMENT	**(9)**
.Selection based on equipment performance - Equipment operations - Maintenance - Organize maintenance team - Training - Scheme for maintenance - Monitoring and effectiveness of management - Log book.	
UNIT V - EQUIPMENT SAFETY MANAGEMENT	**(9)**
Training - Identification of needs - Training methods - Programmes, seminars, conferences and competitions - Safety training - Role of government agencies and private consulting agencies - Safe practice - Method of Promoting - Motivation, communication, creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme and safety campaign - Domestic safety and training.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Sharma S.C., "Construction Equipment and Management", Khanna Publishers, New Delhi, 2017
2. Dr. Mahesh Varma, "Construction Equipment and its planning and Application", Metropolitan Book Company, New Delhi. 2010

REFERENCES:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C. "Construction Planning, Equipment and Methods", 6th ed., Tata McGraw-Hill, New Delhi, 2013
2. Dr.S. Seetharaman, "Construction Engineering and Management", Umesh Publications, 5th ed., 2015.
3. Deodhar, S.V., "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2017
4. https://basiccivilengineering.com/2015/04/type - of - equipment - use-in-construction.html

17CEX32 - RESOURCE MANAGEMENT IN CONSTRUCTION			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program Outcomes
1.0	To impart knowledge on the various functional areas of manpower.	**1.1**	Examine natured manpower in the construction field.	c,f,l
2.0	To impart knowledge on the classification, procurement, store management of materials.	**2.1**	Execute the management of construction materials effectively.	e,g,k
3.0	To expose the management of machinery used in field.	**3.1**	Select the equipment safely and maintaining the service records in a streamlined manner.	e,g,i,l
4.0	To provide the necessary knowledge on the various time management techniques.	**4.1**	Prepare the time phases of project and complete it within the stipulated time.	f,g,k,l
5.0	To impart knowledge on the types of cost and its management.	**5.1**	Discuss various costs involved in the project and carryout the time-cost trade off.	g,h,k

UNIT I - MANPOWER MANAGEMENT	**(9)**
Introduction - Organization - Fulcrum of the modern enterprise - Informal groups - Management - Employees - Human resource management	
UNIT II - MATERIAL MANAGEMENT	**(9)**
Importance - Classification and Codification of materials - Inventory control - Managing the inventory and flow of raw materials, Work - in - Process, Finished Goods, and Supplies to ensure / enhance the organization's competitiveness and profitability - Stores Management - Quality control, Use of Material Management Systems (MMS).	
UNIT III - MACHINERY MANAGEMENT	**(9)**
Identification - Planning - Equipment Management in Projects - Maintenance Managements - Replacement - Cost Control of equipment - Depreciation Analysis - Safety Management.	
UNIT IV - TIME MANAGEMENT	**(9)**
Evolution of time management concepts - Need for time management - Challenges of project management (delays in pre-execution, construction phase) - Methods and processes for time management as per IS 15883-II, PMBOK - Work Breakdown Structure.	
UNIT V - COST MANAGEMENT	**(9)**
Time Cost Analysis - Cost components of a construction project - Direct and indirect costs - Critical Chain Project Management - Delay Management - Earned Value Management (EVM) - Cost-Time Relationships - Utility Curves - S-Curves - Time-Cost trade-off.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. A.K. Datta, "Materials Management: Procedures, Text and Cases", PHI Learning Pvt. Ltd., 2009.
2. Michael R. Canter, "Resource Management for Construction: An Integrated Approach", Macmillan, 3rd ed., 2005.

REFERENCES:

1. Glenn .A, Sears and Reichard, Clough .H, “Construction Project Management - A practical guide to field construction management”, John Wiley and Sons, Inc, 2009
2. Richard J. Tersine, “Principles Of Inventory And Materials, Management”, Prentice Hall,2004
3. P. Gopalakrishnan, Abid Haleem, “Handbook of Materials Management”, PHI Learning Pvt. Ltd.2015

17CEX33 - QUALITY CONTROL IN CONSTRUCTION				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program Outcomes
1.0	To impart knowledge on the concepts of quality in construction site.	**1.1**	Interpret the quality check, audit and inspection	f,g,l
2.0	To provide the necessary knowledge about the quality improvement process.	**2.1**	Explain different quality improvement techniques.	e,f,g
3.0	To give an overview of the quality inspection program.	**3.1**	Execute quality inspection in the various construction works.	f,j,k,l
4.0	To introduce the concept of quality management system.	**4.1**	Adopt different quality management techniques, assurance and control techniques in construction industries.	f,i,l
5.0	To acquire knowledge on the quality management system and environment management system.	**5.1**	Employ ISO 9000 and ISO 14000 based on the functional nature of industries	c,e,f,h,l

UNIT I - QUALITY	**(9)**
Introduction - Quality Contributors at a Construction Site - Quality plan, quality audits, quality manual, PDCA cycle - Factors influencing construction quality - Quality plan - Inspection procedures - Total QA / QC programme.	
UNIT II - QUALITY IMPROVEMENT TECHNIQUES	**(9)**
Excavation, Backfilling and Compaction - Tiling - Plastering - Waterproofing - Factors affecting Quality and Reliability - Quality control, tests and checklist - Quality in Execution - Good practices and Precautions - Remedial measures - Documentation	
UNIT III - QUALITY INSPECTION PROGRAM	**(9)**
Concrete Mix Design - Concrete Quality - Formwork: Types, Quality control, checklist - pre, during and after, compliance - RCC Works: Coordinate checks, Pre and post pour checks - Defects in RCC Work, Precautions, Good practices, documentation - Brickwork and Blockwork Check for quality and compliance - Remedial measures, documentation - Inspection - Purpose - Reports and records	
UNIT IV - QUALITY MANAGEMENT	**(9)**
.Objectives - Authority and responsibilities - Quality management guidelines - Quality councils and circles - Quality system documents - Quality related training - Implementing a quality system - Third party certification	
UNIT V - QUALITY STANDARDS	**(9)**
Quality standards - Quality of cement, bricks, steel and concrete - Provisions of Indian standards - ISO 9000 and ISO 14000 standards.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Abdul Razzak Rumane, “Quality Management in Construction Projects”, CRC Press, 2nd ed., 2018.
2. O'Brien, James J, “Construction Inspection Handbook - Total Quality Management”, Springer, 3rd ed., 2012.

REFERENCES:

1. Hutchins.G, "ISO 9000 : A Comprehensive Guide to Registration, Audit Guideline and Successful Certification", Viva Books Pvt. Ltd.,
2. Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis: From Product Development through use", McGraw Hill, 6th ed., 2010.

17CEX34 - INTELLIGENT BUILDING TECHNIQUES				
L	T	P	C
3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To impart knowledge on the concepts of intelligent materials and buildings.	**1.1**	Analyse and fix the materials and technology involved in the intelligent buildings.	g,l
2.0	To study the functions of building comfort systems and its components	**2.1**	Choose the appropriate comfort systems and fabricate the HVAC system efficiently and effectively	e,f,i
3.0	To give an overview of the modern safety systems fitted in the building.	**3.1**	Execute ample safety measures that are required for the building in order to avert building accidents.	c,e,i
4.0	To understand the concepts of the electronics and communication systems involved in the modern buildings.	**4.1**	Select correct electronic components and construct a state of art built in electronic systems.	c,e,i
5.0	The factors which have influence on the performance of buildings	**5.1**	Improve the performance of buildings in terms of energy efficiency, clean environment and air pollution	c,e,g,l

UNIT I - INTELLIGENT BUILDINGS	**(9)**
Basic concepts - Intelligent building automation - Cost analysis - Smart materials and embedded sensor technology - Building management system and energy savings - Benefits.	
UNIT II - INTELLIGENT COMFORT SYSTEMS	**(9)**
Basic HVAC system - Human comfort - Sensor - Occupancy sensors and temperature sensors - Energy efficient HVAC systems - Thermal energy storage - Under floor air distribution - Chilled beams - Other emerging HVAC technologies for high performance buildings - Automated car parking management.	
UNIT III - INTELLIGENT SAFETY SYSTEMS	**(9)**
Life safety factors - Intrusion sensors - Space sensors - Closed circuit television and surveillance systems - Access control management system - Portrait id, swipe card access control, biometric access control - Fire protection systems - Smoke detection, automatic fire alarm detection, sprinklers, hose reels hydrants, foam systems - Microprocessor based alarm - Emergency control of elevator, doors, HVAC systems - Security and alarm system.	
UNIT IV - BUILDING ELECTRONICS	**(9)**
.Microprocessor based control - Programmable logic controller - Communication principles - Telephone systems - Communal aerial broadcasting - Satellite communication - Fibre optic system.	
UNIT V - PERFORMANCE BUILDINGS	**(9)**
High performance buildings - Control theory - Market trends - Energy efficiency - Environmental and greenhouse gas emission reduction - Clean development Mechanism - Practical benefits - Smart home - Smart office.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Shengwei Wang, "Intelligent Buildings and Building Automation", Spon Press, London, 2010.
2. Derek Clements Croome, "Intelligernt Building: Design, Management and Operations", 3rd ed., Telford ICEP Publishers, London, 2014.

REFERENCES:

1. Ehrlich, C., “Intelligent Building Dictionary: Terminology for Smart, Integrated Green Building Design, Construction, and Management”, San Francisco, Handson - Guide, 2007.
2. https://www.iofficecorp.com/blog/intelligent-building - examples

17CEX35 - EARTH AND ROCK FILL DAMS					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program Outcomes**
1.0	To understand the factors influence design of rock fill dams	**1.1**	Assess the causes of failure and damage of embankments and slopes.		a,c,g,h,l
2.0	To learn reasons for failure and damages of embankments and slopes.	**2.1**	Analyse the stability of slopes for various seepage conditions and apply the concept in the design of earth and rock fill dams.		a,b,c,f,g,k
3.0	To impart knowledge on failure criteria for hydraulic fracturing	**3.1**	Apply the knowledge of engineering and assess the stability of dam against hydraulic fracturing and suggest suitable remedial measure.		a,c,l,k
4.0	To study damages of embankments and slopes, various methods of analysis of slopes and remedial techniques to protect the slopes.	**4.1**	Identify the nature of failures and damages in earth and rock fill dams and apply the concept in field to avoid distress.		a,b,c,g
5.0	To understand the remedial techniques to protect the slopes.	**5.1**	Recommend suitable remedial measures to protect the slopes and implement quality control and monitor its performance		a,d,g

UNIT I - DESIGN CONSIDERATION	**(9)**
Design consideration, Factors influencing design, Types of earth and rock fill dams, Design details, Provisions to control pore pressure.	
UNIT II - SLOPE STABILITY AND SEEPAGE ANALYSIS	**(9)**
Stability of infinite and finite slopes, Method of Slices, Bishop's method, Flow nets, Stability conditions during construction, Full reservoir and drawdown - cut off walls - Trenches - Importance of drainage and filters.	
UNIT III - HYDRAULIC FRACTURING	**(9)**
Introduction, Conditions and mechanisms for hydraulic fracturing, Failure criterion for hydraulic fracturing - cubic specimen with a crack - core with a transverse crack - core with a vertical crack, strike - dip of easiest crack spreading; factors affecting hydraulic fracturing, self - healing of a core crack.	
UNIT IV - FAILURE AND DAMAGES	**(9)**
Failure and damages, Nature and importance of failures in embankment and foundation - Piping, Differential settlement, Foundation slides, Earthquake damage, creep and anisotropic effects, Reservoir wave action, Dispersive piping.	
UNIT V - SLOPE PROTECTION MEASURES	**(9)**
Special design problems, Slope protection, Filter design, Foundation treatment, Earth dams on pervious soil foundation, Application of geosynthetic materials in filtration. Treatment of rock foundation, Construction Techniques, Quality control and performance measurement.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Rowe, R.K., "Geotechnical and Geoenvironmental Engineering Handbook", Kulwer Academic Publishers, 2001.
2. Anderson, M.G., and Richards, K.S., "Slope Stability", John Wiley, 1987.

3. McCarthy, D.F., “Essentials of Soil Mechanics and Foundations: Basic Geotechnics”, 16th ed., Prentice Hall, 2002.

REFERENCES:

1. Bramhead, E.N., “The Stability of Slopes”, Blacky Academic and Professionals Publications, Glasgow, 1986.
2. Chandhar, R.J., “Engineering Developments and Applications”, Thomas Telford, 1991
3. Koerner, R.M. “Designing with Geosynthetics”, 3rd ed., Prentice Hall, 1997.
4. Jun-Jie Wang,” Hydraulic Fracturing in Earth-rock Fill Dams”, John Wiley & Sons, 2014 Sherard, J.L.,
5. Woodward, R.J., Gizienski, R.J. and Clevenger, W.A., “Earth and Earth Rock Dam”, John Wiley, 1963.

17CEX36 - PARTICPATORY WATER RESOURCES MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program Outcomes**	
1.0	To understand the regional and global experiences of participatory ideology in irrigation water management	**1.1**	Capture to fundamental concepts and terms which are to be applied and understood all through the study	f,g	
2.0	To acquire knowledge on paradigms shifts and reorientations with regard to stakeholder participation in water management in general and in irrigation management in particular.	**2.1**	State a clear insight of participatory ideology with its rudiments under the light of both national and international illustrative cases.	c,g	
3.0	To get idea on the importance of water resource management	**3.1**	Comprehend the roles of different players as stakeholders with the ground reality of the underlying issues in farm community.	c,f,j,i	
4.0	To identify the components of water storage structures along with its functions	**4.1**	Express how reforms can help build up institutional and irrigation agencies with the support obtained from the existing farm network in irrigation Management	f,j,l,k	
5.0	To impart knowledge on policies for emerging challenges	**5.1**	Recommend irrigation management with a vision to transform the existing governance and policies with the novel approach of sustainability.	f,g	

UNIT I - FUNDAMENTALS OF SOCIOLOGY AND PARTICIPATORY APPROACH	**(6)**
Basic Sociological concepts and Definitions - Objectives - Perspectives - Social stratification - Sociological understanding - Irrigation as a Sociotechnical Process - paradigm shift and Participatory approach	
UNIT II - UNDERSTANDING FARMERS PARTICIPATION	**(12)**
Need of farmers participation –Benefits of farmers participation - Comparisons of cost and benefit Water User Association - Membership - Kinds of participation - National and International Experiences - Activities on Water towards Organization and Structure - Context of participation-factors in the environment.	
UNIT III - ROLE OF STAKEHOLDERS AND THE UNDERLYING ISSUES	**(12)**
Multiple use of water - Issues in sectoral water allocation - Domestic, Irrigation, Industrial sectors - Woman as a water user - Constraints and Opportunities. Role of community organisers - Constraints in organising farmers organisation.	
UNIT IV - IMPROVING AGENCY RELATIONS AND INSTITUTIONAL REFORMS	**(10)**
Supporting farmer organization and participation - Decision Making - Leadership and responsibilities - Development strategy - Channels for implementation - Equity and Equality - Agency Incentives - Technical co-operation - Special roles - Agency Roles - Institutional Reforms	
UNIT V - POLICY CONSIDERATIONS AND EMERGING CHALLENGES	**(5)**
Water Policy - Irrigation Governance - Building from Below - Non-political Associations - Bureaucratic Reorientation - Policy options and Alternatives and Sustainability.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Sivasubramanium K., “Water Management”, SIMRES Publication, Chennai 2009
2. Michael C.M., Putting people first, “Sociology variables in Rural Development”, Oxford University press, London 1985.

REFERENCES:

1. Desai A.R., “Rural sociology in India”, Popular Prakashan, Bombay, 1969.
2. Uphoff. N., “Improving International Irrigation management with Farmer Participation - Getting the process Right - Studies in water Policy and management”, New West - View press, Boulder and London, 1986.
3. http://irapindia.org/IMTInIndia-Pa
4. http://mowr.gov.in/writereaddata/mainlinkFile/File421.pdf

17CEX37 - WATER RESOURCES SYSTEMS ENGINEERING				
L	T	P	C
3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program Outcomes
1.0	To introduce the student to the concept of Mathematical approaches for managing the water resources system and apply to operate a water resource system optimally.	**1.1**	Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project.	d.f.g
2.0	To gain a better understanding of the complex interactions among all the hydrologic, ecologic, economic, engineering and social components of water resource systems, analyses based on systems perspectives	**2.1**	Apply the concept of linear programming for optimisation of water resources problems.	b,d,e,f
3.0	To introduce the science and art of developing and applying various modeling approaches in support of water resources planning and management	**3.1**	Explain the concept of dynamic programming and apply in water resource system.	e,f,g,i
4.0	To emphasize the practice of developing and using models to address specific water resources planning and management issues and problems.	**4.1**	Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy	c,e,g
5.0	To provide relevant, objective, timely and meaningful information to those who are responsible for deciding how we develop, manage, and use our water resources.	**5.1**	Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management	b,c,e

UNIT I - SYSTEM APPROACH	**(9)**
Definition, classification, and characteristics of systems - Philosophy of modelling - Goals and Objectives - Basics of system analysis concept - steps in systems engineering.	
UNIT II - LINEAR PROGRAMMING	**(9)**
Introduction to Operation research - Linear programming Problem Formulation - graphical solution Simplex method - Sensitivity analysis - application to operation of single purpose reservoir	
UNIT III - DYNAMICPROGRAMMING	**(9)**
Bellman's optimality criteria, problem formulation and solutions - Water Allocation for three state (user), Forward and Backward Recursion techniques in Dynamic Programming - Shortest pipe line route problem - Application to reservoirs capacity expansion	
UNIT IV - SIMULATION	**(9)**
Basic principles and concepts - Monte Carlo techniques - Model development - Inputs and outputs - Single and multipurpose reservoir simulation models - Deterministic simulation - Rule Curve development for reservoir	
UNIT V - ADVANCEDOPTIMIZATIONTECHNIQUES	**(9)**
Integer and parametric linear programming - Goal programming types - Applications to reservoir release optimization - application of evolutionary algorithms like Genetic algorithm, Particle swarm, Simulated Annealing to reservoir release optimization	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Vedula, S., and Majumdar, P.P. “Water Resources Systems - Modeling Techniques and Analysis”, Tata McGraw Hill, New Delhi, Fifth reprint, 2010.
2. Bhave PR, “Water Resources Systems”, Narosa Publishers, 2011

REFERENCES:

1. Gupta, P.K., and Man Mohan, “Problems in Operations Research (Methods and Solutions)”, Sultan Chand and Sons, New Delhi, 1995.
2. Chaturvedi, M.C., “Water Resources Systems Planning and Management”, Tata McGraw Hill, New Delhi, 1997.
3. Taha, H.A., “Operations Research”, McMillan Publication Co., New York, 1995.

17CEX38 - WATERSHED CONSERVATION AND MANAGEMENT				
L	T	P	C	
3	0	0	3	

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To make the student understand the watershed based water resources development and implementation of conservation practices	**1.1**	Recognize and Interpret the morphological features of a watershed	c,g,
2.0	To provide the technical and sociological understanding of a watershed.	**2.1**	State, design and sketch the soil conservation structures.	a,c,g,k
3.0	To provide a comprehensive discourse on the engineering practices of watershed management for realizing the higher benefits.	**3.1**	Describe the micro catchment and apply the concepts to design the small water harvesting structures.	b,c,g,h
4.0	To Implant the sustainable management of natural resources of the watershed	**4.1**	Illustrate the application of modern tools and technology in the management of watershed	e,g,j
5.0	To access better watershed management plan for applications of Remote Sensing and GIS	**5.1**	Classify the management activities and to develop an integrated watershed development plan.	g,i,k

UNIT I - WATERSHED CONCEPTS	**(9)**
Watershed - Definition, Need and Elements - Principles - Influencing Factors: Geology - Soil - Morphological Characteristics - Toposheet - Delineation - Codification - Prioritization - Watershed Atlas.	
UNIT II - SOIL CONSERVATION MEASURES	**(9)**
Types of Erosion - Water and Wind Erosion: Causes, Factors, Effects and Management - Soil Conservation Measures: Agronomical and Mechanical - Design of Terraces and Bunds - Estimation of Soil Loss - USLE Equation - Sedimentation.	
UNIT III - WATER HARVESTING AND CONSERVATION	**(9)**
Yield from a Catchment - Traditional Water Harvesting Techniques - Micro - Catchments - Design of Small Water Harvesting Structures: Farm Ponds, Percolation Tanks, Check dams, Grassed Waterways.	
UNIT IV - GIS FOR WATERSHED MANAGEMENT	**(9)**
Applications of Remote Sensing and Geographical Information System - Role of Decision Support System - Conceptual Models and Case Studies.	
UNIT V - WATERSHED MANAGEMENT	**(9)**
Project Proposal Formulation - Watershed Development Plan - Entry Point Activities - Watershed Economics - Agroforestry - Grassland Management - Wasteland Management - Watershed Approach in Government Programmes - People's Participation - Evaluation of Watershed Management Programmes - Integrated Watershed Management - Case studies	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Ghanashyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, Second Edition, 2009.
2. Suresh, R. "Soil and Water Conservation Engineering", Standard Publishers and Distributors Private Limited, New Delhi, 2020.

REFERENCES:

1. Glenn O Schwab, "Soil and Water Conservation Engineering", Wiley India Private Limited, 2009.
2. Heathcote, I. W. "Integrated Watershed Management: Principles and Practice", John Wiley and Sons, Inc., New York, 2nd ed., 2009.
3. John G. Lyon, "GIS for Water Resources and Watershed Management", CRC Press, 2002.
4. Vijay P. Singh, Donald K. Frevert, "Watershed Models", CRC Press, 2005.

17CEX39 - INTEGRATED WATER RESOURCES MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE: NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes The students will be able to**		**Related Program Outcomes**	
1.0	To introduce the concepts and principles of IWRM.	**1.1**	Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.	**d,g**	
2.0	To gain knowledge on role of disciplines of ecology and socio-economic play in management of water resources.	**2.1**	Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.	**c,f,k**	
3.0	To expose to global food security and public-private participation issues and legal and regulatory settings, in the context of IWRM	**3.1**	Apply law and governance in the context of IWRM	**c,f,g**	
4.0	To introduce the economics, public-private partnership.	**4.1**	Discuss the linkages between water-health; develop a HIA framework	**c,f,g**	
5.0	To understand water & health, water & food security and legal & regulatory settings.	**5.1**	Analyse how the virtual water concept pave way to alternate policy options	**f,i,k**	

UNIT I - CONTEXT FOR IWRM	**(9)**
Water as a global issue: Key challenges - Definition of IWRM within the broader context of development - Key elements of IWRM - Principles - Paradigm shift in water management - Complexity of the IWRM process - UN World Water Assessment - SDGs	
UNIT II - WATER ECONOMICS	**(9)**
Economic view of water issues: Economic characteristics of water good and services - Non-market monetary valuation - Water economic instruments - Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.	
UNIT III - LEGAL ANDREGULATORYSETTINGS	**(9)**
Basic notion of law and governance: Principles of International and National law in the area of water management - Understanding UN law on non-navigable uses of International water courses - International law for groundwater management - World Water Forums - Global Water Partnerships - Development of IWRM in line with legal and regulatory framework: Case Studies.	
UNIT IV - WATER AND HEALTH WITHIN THE IWRMCONTEXT	**(9)**
Links between water and health: Options to include water management interventions for health - Health protection and promotion in the context of IWRM - Global burden of Diseases - Health impact assessment of water resources development projects - Case studies.	
UNIT V - AGRICULTURE IN THE CONCEPT OF IWRM	**(9)**
Water for food production: 'blue' versus 'green' water debate - Water foot print - Virtual water trade for achieving global water and food security - Climate Smart Agriculture - Current water pricing policy - Scope to relook pricing.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Cech Thomas V., "Principles of water resources: history, development, management and policy", John Wiley and Sons Inc., New York. Fourth Edition 2018.
2. Mollinga.P, "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.

REFERENCES:

1. Technical Advisory Committee, “Integrated Water Resources management”, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
2. Technical Advisory Committee, “Effective Water Governance”, Technical Advisory Committee Background Paper No: 7. Global water partnership, Stockholm, Sweden, 2003.
3. Tony Allan, Virtual Water : Tackling the Threat to Our Planet’s Most Precious Resource, I. B. Taurus, 2011.

17CEX40 - URBAN WATER INFRASTRUCTURE					
		L	T	P	C
		3	0	0	3

PREREQUISITE: NIL

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To impart knowledge and skills relevant to water management in the context of urbanization.	**1.1**	Explain various functional elements of urban ecosystem	**f,g**
2.0	To introduce the concepts of water management in the context of urbanization and relate engineering principles to water supply, storm water and wastewater management.	**2.1**	Calculate urban runoff, compute supply and demand of water, draw hydrograph	**f,g**
3.0	To introduce to the concepts of urbanization and its impact on the natural water cycle.	**3.1**	Compare advantages of Newer techniques of green infrastructure and illustrate benefits	**d,g**
4.0	To prepare Master plans for urban water management.	**4.1**	Assess the Operation and Maintenance needs of urban water systems	**d,g,i**
5.0	To introduce the concepts of regulations and best management practices from around the world.	**5.1**	Propose best management practices for Indian context	**f,i,k**

UNIT I - URBAN ECOSYSTEM	**(9)**
Cities as Ecological system - hybrid ecosystem - Resilience in urban ecosystem. Human components of Ecosystem - Urban pattern and Ecosystem function. Population and Community dynamics, functions of Urban Ecosystem.	
UNIT II - URBAN HYDROLOGY	**(9)**
The urban hydrological cycle - Function - Human induced changes in urban watershed - Hydrological calculation - Runoff - Infiltration - hydrograph.	
UNIT III - URBAN STORM WATER MANAGEMENT	**(9)**
Design of Drainage System - Roadway Drainage Analysis - Types of inlet - Inlet design - Design of storm drain - Storm water management regulations - Structural Storm Management systems - Newer trends in storm water management (Green infrastructure) - Installation - Operation and maintenance.	
UNIT IV - WATER CONSERVATION AND REUSE	**(9)**
Trends in supply and demand - Indoor conservation - Outdoor conservation - Water reuse - Rainwater harvesting - public education	
UNIT V - WATER GOVERNANCE	**(9)**
Challenges in water sector - Institutional setting, Supply Management, Demand Management, Waste water management - Private sector participation, urban service delivery, customer satisfaction, financial resource management – case studies of best practices in cities across the world.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Anand Chiplunkar, K Seetharam and Cheon Kheong (ed)), "Good Practices in urban water management" ADB, National University Singapore, 2012
2. Marina Alberti (2008), "Advances in Urban Ecology", Springe R
3. Mohammad Karamouz, Ali Moridi, Sara Nazif , , "Urban Water Engineering and Management", 1st ed., CRC Press ,2010

REFERENCES:

1. HormozPazwash (2016), "Urban storm water management", CRC Press
2. Larry W. Mays, (2004), Urban Stormwater Management Tools, McGraw-Hill Companies

17CEX41- WATER QUALITY AND MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE: NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes The students will be able to**		**Related Program Outcomes**	
1.0	To understand the fundamentals of mathematical models and their importance in water quality modeling.	**1.1**	Identify the principles of water quality modelling.	**b,g**	
2.0	To impart the skills to use water quality modelling software for surface and groundwater quality modelling.	**2.1**	Choose the pollutant transport phenomena in surface and groundwater.	**f,g**	
3.0	To introduce water quality concepts, its evaluation	**3.1**	Apply the knowledge of surface water quality modelling to predict the water quality of rivers, lakes and estuary.	**c,f**	
4.0	To understand the importance of water quality and Management and major uses of water and the role environmental issues.	**4.1**	Predict the groundwater contamination transport.	**d,e,g**	
5.0	To study about transportation of pollution contaminants	**5.1**	Predict water quality of surface and sub surface water using numerical solution	**c,e,g,i**	

UNIT I - MODELLING INSIGHTS	**(9)**
Engineers and Mathematical models - Water quality models - historical development - different types of models - steps in model development - importance of model building - calibration and verification of models - finite element, finite difference and finite volume methods	
UNIT II - POLLUTION TRANSPORT	**(9)**
Transport phenomena - advection, diffusion, dispersion - contamination transport in surface and subsurface water - Simple transport models - steady state and time variable solutions - conservation of mass, momentum and energy balance, governing equation for contaminant fate and transport	
UNIT III - SURFACE WATER QUALITY MODELLING	**(9)**
Water quality modeling of streams, lakes and estuaries - water quality– model sensitivity - assessing model performance; Models for dissolved oxygen, pathogens and COD, BOD - Streeter Phelp's model for point and distributed sources - modified streeter Phelp's equations.	
UNIT IV - GROUNDWATER QUALITY MODELLING	**(9)**
Groundwater flow and mass transport of solutes - groundwater quality modelling using numerical methods - Parameters, Input - output stresses, Initial and Boundary conditions - degradation of organic compounds in subsurface - Model calibration : steady state and unsteady state - sensitivity analysis – Model validation - seawater intrusion - basic concepts and modelling.	
UNIT V - WATER QUALITY MANAGEMENT MODELS	**(9)**
Exposure to surface water and groundwater quality modelling software's - MIKE 21, WASP, QUAL2E and MODFLOW - demonstration - case studies - Modeling multilayer groundwater flow system - Artificial recharge feasibility through modeling - Groundwater contamination, restoration and management.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Steven C. Chapra, "Surface Water Quality Modelling", Tata McGraw-Hill Companies, Inc., New Delhi2018.
2. Benedini, Marcello, Tsakiris, George, "Water Quality Modelling for Rivers and Streams", Springer Netherlands, 2017.

REFERENCES:

1. Jacob Bear, A. H.-D. Cheng, “Modelling Groundwater Flow and Contaminant Transport”, Springer Science & Business Media, 2010.
2. Ne-Zheng Sun, Alexander Sun “Mathematical Modelling of Groundwater Pollution”, Springer New York, 2012

17CEX42 - RAIN WATER HARVESTING					
		L	T	P	C
		3	0	0	3
PREREQUISITE: NIL					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes The students will be able to**		**Related Program Outcomes**	
1.0	To impart knowledge and skills relevant to water conservation and management towards achieving the sustainability in water resources	**1.1**	Interpret the need and importance of water conservation through global and Indian practices of rainwater harvesting	**e,g**	
2.0	To relate the engineering principles and practices in estimation of runoff, storage, recharge into the ground	**2.1**	Apply the concepts of hydrology and groundwater in the estimation of runoff and recharge potentials	**b,k**	
3.0	To understand the methods of rain water harvesting.	**3.1**	Identify the various types of rainwater harvesting methods and apply it on the field	**e,g,i,l**	
4.0	To study the concepts of rain water harvesting structures.	**4.1**	Design the various RWH structures to harvest the rainwater in surface and subsurface	**c,e,i,j**	
5.0	To understand the maintain the system through the best management practices followed around the world.	**5.1**	Explain the difficulties of RWH, evaluation methods and maintenance through various case studies.	**c,f,l,k**	

UNIT I - BASICS OF RWH	**(9)**
Water and its sources - Need for water conservation - Types of water demand - Conservation Methods - Global and Indian perspectives - National mission and goals towards rainwater harvesting - National water policy - Legislation on rainwater harvesting in India and Tamil Nadu.	
UNIT II - HYDROLOGY AND GROUND WATER	**(9)**
Hydrological cycle - Precipitation - Rainfall measurement - Rain-gauges - Hyetograph - Infiltration - Runoff estimation - Rooftop runoff estimation. Ground water - Aquifer Properties - Darcy law and well hydraulics - Steady flow.	
UNIT III - METHODS OF RAINWATER HARVESTING	**(9)**
Rainwater harvesting potential of an area - Traditional harvesting practices - Rooftop harvesting - Methods of RWH structures - Site selection for rainwater harvesting - Surface runoff Harvesting - Ground water recharge - Artificial recharge.	
UNIT IV - DESIGN OF RAINWATER HARVESTING STRUCTURES	**(9)**
Design Considerations - Components of Rainwater harvesting system - Simple roof water collection system - Design of Storage structure - Design of Recharge structures - Recharge pit - Recharge trench - Recharge well - Gully plug - Contour bund - Percolation tank - Check dam - Recharge shaft - Efficiency of RWH system	
UNIT V - MANAGEMENT OF RWH AND CASE STUDIES	**(9)**
Difficulties in RWH - At catchment level - At household level - Evaluation of RWH systems - Maintenance of RWH structures - Modernisation of RWH system - Case studies on best practice of RWH in urban - Success stories of Contemporary practices of RWH in India.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. H.M Raghunath “Ground Water” 3rd ed., New Age International 2007.
2. Jayarami Reddy.P, “A Text book of Hydrology”, Firewall media Publication, 2005
3. Ramakrishnan S, “Ground Water”, Scitech Publications (India) Pvt Ltd, 2010

REFERENCES:

1. Rainwater Harvesting: Indian Railway Institute of Civil Engineering Pune, October 2015.
2. A Manual on “Rainwater Harvesting and Conservation”: Government of India, Consultancy Service Organization Central Public Works Department, New Delhi.
3. “A Water Harvesting Manual for Urban Areas” , Centre for Science and Environment.
4. Traditional Water Harvesting Systems of India, C.P.R. Environmental Education Centre, Chennai, India (2004).

17CEM01 - SUSTAINABLE INFRASTRUCTURE DEVELOPMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES ANDOUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to		**Related Program Outcomes**	
1.0	To impart knowledge about sustainable Infrastructure development goals, practices.	**1.1**	Relate the environment sustainability goals at global and Indian scenario	**f,g,j**	
2.0	To understand the concepts of sustainable planning and design.	**2.1**	Assess the risks in development of projects and suggest mitigation measures	**c,f,k**	
3.0	To understand the concepts of construction, maintenance.	**3.1**	Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects	**c,f,i**	
4.0	To impart knowledge about sustainable materials for construction	**4.1**	Explain Life Cycle Analysis and life cycle cost of construction materials.	**c,f,h**	
5.0	To understand the concepts of decommissioning of infrastructure projects.	**5.1**	Apply the new technologies for maintenance of infrastructure projects.	**e,f,l**	

UNIT I - SUSTAINABLE DEVELOPMENT GOALS	**(9)**
Definitions, principles and history of Sustainable Development - Sustainable development goals (SDG): global and Indian - Infrastructure Demand and Supply - Environment and Development linkages - societal and cultural demands - Sustainability indicators - Performance indicators of sustainability and Assessment mechanism - Policy frameworks and practices: global and Indian - Infrastructure Project finance - Infrastructure project life cycle - Constraints and barriers for sustainable development - future directions.	
UNIT II - SUSTAINABLE INFRASTRUCTURE PLANNING	**(9)**
Overview of Infrastructure projects: Housing sector, Power sector, Water supply, road, rail and port transportation sector, rural and urban infrastructure. Environmental Impact Assessment (EIA), Land acquisition - Legal aspects, Resettlement &Rehabilitation and Development - Cost effectiveness Analysis - Risk Management Framework for Infrastructure Projects, Economic, demand, political, socio-environmental and cultural risks. Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Negotiating with multiple Stakeholders on Infrastructure Projects. Use of ICT tools in planning - Integrated planning - Clash detection in construction - BIM (Building Information Modelling).	
UNIT III - SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES	**(9)**
Sustainability through lean construction approach - Enabling lean through information technology - Lean in planning and design - IPD (Integrated Project Delivery) - Location Based Management System - Geospatial Technologies for machine control, site management, precision control and real time progress monitoring - Role of logistics in achieving sustainable construction - Data management for integrated supply chains in construction - Resource efficiency benefits of effective logistics - Sustainability in geotechnical practice - Design considerations, Design Parameters and Procedures - Quality control and Assurance - Use of sustainable construction techniques: Precast concrete technology, Pre-engineered buildings	

UNIT IV - SUSTAINABLE CONSTRUCTION MATERIALS	(9)
Construction materials: Concrete, steel, glass, aluminium, timber and FRP - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Sustainable consumption - Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility - Design for Environment Strategies, Practices, Guidelines, Methods, And Tools. Eco-design strategies -Design for Disassembly - Dematerialization, rematerialization, transmaterialization - Green procurement and green distribution - Analysis framework for reuse and recycling - Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian Eco mark scheme - Environmental product declarations - Environmental marketing- Life cycle Analysis (LCA), Advances in LCA: Hybrid LCA, Thermodynamic LCA - Extending LCA - economic dimension, social dimension - Life cycle costing (LCC) - Combining LCA and LCC - Case studies	
UNIT V - SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS	**(9)**
Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions - Use of Emerging Technologies - IoT, Big Data Analytics and Cloud Computing, Artificial Intelligences, Machine and Deep Learning, Fifth Generation (5G) Network services for maintenance .	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Charles J Kibert, “Sustainable Construction: Green Building Design & Delivery”, 4th ed., Wiley Publishers 2016.
2. Steve Goodhew, “Sustainable Construction Process”, Wiley Blackwell, UK, 2016.
3. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher : Belhaven Press,ISBN:1852930039.

REFERENCES:

1. Craig A. Langston & Grace K.C. Ding, “Sustainable Practices in the Built Environment”, Butterworth Heinemann Publishers, 2011.
2. William P Spence, “Construction Materials, Methods & Techniques (3e)”, Yesdee Publication Pvt. Ltd, 2016.

17CEM02 - GREEN TECHNOLOGY					
		L	T	P	C
		3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES ANDOUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To impart knowledge on the principles of green chemistry	**1.1**	Identify the principles of green engineering and technology	**g,i,k,l**
2.0	To provide green engineering solutions to energy demand, reduced energy footprint	**2.1**	Explain about pollution using hazardous chemicals and solvents	**f,g,j**
3.0	To get idea on green systems and the environment, energy technology and efficiency, and sustainability.	**3.1**	Modify processes and products to make them green and safe.	**c,e,g,i**
4.0	To understand the concept of design on green technology	**4.1**	Design processes and products using green technology	**c,f,g,l**
5.0	To acquire knowledge about materials used for green technology	**5.1**	Interpret advanced technology in green synthesis	**e,g,k,l**

UNIT I - PRINCIPLES OF GREEN CHEMISTRY	**(9)**
Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.	
UNIT II - POLLUTION TYPES	**(9)**
Pollution - types, causes, effects, and abatement. Waste - sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.	
UNIT III - GREEN REAGENTS AND GREEN SYNTHESIS	**(9)**
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions	
UNIT IV - DESIGNING GREEN PROCESSES	**(9)**
Safe design, process intensification, in process monitoring. Safe product and process design - Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention	
UNIT V - GREEN NANOTECHNOLOGY	**(9)**
Nano materials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. B. Billatos, Nadia A. Basaly, Taylor& Francis Samir, “Green Technology and Design for the Environment”, Washington, DC, 1997
2. M. Lancaster, “Green Chemistry - An Introductory Text”, RSC, 2016.
3. Alexi Lapkin and david Constable (Eds), “Green Chemistry Metrics “,Wiley publications,2008

REFERENCE:

1. Stanley E Manahan, Taylor and Francis, “Environmental Chemistry”, 2017

17CEM03 - MATERIALS FOR ENERGY SUSTAINABILITY					
			L	T	P	C
			3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES ANDOUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To Familiarize about the challenges and demands of energy sustainability	**1.1**	Discuss about energy sustainability	**f,g**
2.0	To Provide fundamental knowledge about electrochemical devices and the materials used.	**2.1**	Explain the principles of different electrochemical devices.	**b,e,g**
3.0	To Introduce the students to various types of fuel cell	**3.1**	Employ the working of fuel cells and their application	**e,f,g**
4.0	To appreciate novel materials and their usage in photovoltaic application	**4.1**	Categorize various Photovoltaic applications and the materials used.	**g,k**
5.0	To Introduce basic principles of various types Super capacitors and the materials used.	**5.1**	Assess different types of super capacitors and the performance of various materials	**c,g,k**

UNIT I - SUSTAINABLE ENERGY SOURCES	**(9)**
Introduction to energy demand and challenges ahead - sustainable source of energy (wind, solar etc.) - electrochemical energy systems for energy harvesting and storage - materials for sustainable electrochemical systems building - India centric solutions based on locally available materials - Economics of wind and solar power generators vs. conventional coal plants - Nuclear energy	
UNIT II - ELECTROCHEMICAL DEVICES	**(9)**
Electrochemical Energy - Difference between primary and secondary batteries - Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O2 battery, Nickel Cadmium, Nickel Metal Hydride) - Primary battery (Alkaline battery, Zinc-Carbon battery) - Materials for battery (Anode materials - Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials - S, LiCoO2, LiFePO4, LiMn2O4) - Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)	
UNIT III - FUEL CELLS	**(9)**
Principle of operation of fuel cells - types of fuel cells (Proton exchange membrane fuel cells, alkaline fuel cell, direct methanol fuel cells, direct borohydride fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, and molten carbonate fuel cells) - Thermodynamics of fuel cell - Fuel utilization - electrolyte membrane (proton conducting and anion conducting) - Catalysts (Platinum, Platinum alloys, carbon supported platinum systems and metal oxide supported platinum catalysts) - Anatomy of fuel cells (gas diffusion layer, catalyst layer, flow field plate, current conductors, bipolar plates and monopolar plates).	
UNIT IV -PHOTOVOLTAICS	**(9)**
Physics of the solar cell - Theoretical limits of photovoltaic conversion - bulk crystal growth of Si and wafering for photovoltaic application - Crystalline silicon solar cells - thin film silicon solar cells - multi junction solar cells - amorphous silicon based solar cells - photovoltaic concentrators - Cu(InGa)Se2 solar cells - Cadium Telluride solar cells - dye sensitized solar cells - Perovskite solar cells - Measurement and characterization of solar cells - Materials used in solar cells (metallic oxides, CNT films, graphene, OD fullerenes, single-multi walled carbon nanotubes, two-dimensional Graphene, organic or Small molecule - based solar cells materials - copper-phthalocyanine and perylenetetra carboxylicbis - benzine - fullerenes - boron subphthalocyanine - tin (II) phthalocyanine)	

UNIT V -SUPERCAPACITORS	(9)

Super capacitor - types of super capacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of super capacitor-three and two electrode cell-parameters of super capacitor- Faradaic and non - Faradaic capacitance - electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite-conductive polypyrrole hydrogels - Different types of nano composites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. John A. Kilner, Stephen J. Skinner, Stuart J. C. Irvine and Peter P. Edwards, “Functional materials for sustainable energy applications”.
2. Parnia Forouzandeh, Vignesh Kumaravel and Suresh C. Pillai , “Electrode Materials for Supercapacitors: A Review of Recent Advances”, Catalysts 2020
3. B.E. Conway, "Electrochemical Super capacitors: Scientific Fundamentals and Technological Applications”, Kluwer Academic / Plenum publishers, New York, 1999.

REFERENCES:

1. T.R. Crompton, Batteries reference book, Newners, 3rd ed., 2002.
2. Wolf Vielstich, Arnold Lamm, Hubert Andreas Gasteiger, Harumi Yokokawa, “Hand Book of Fuel Cells: Fuel Cell Technology and Applications”, Wiley, London 2003.
3. B.Viswanathan. M.Aulice Scibioh , “Materials for Supercapacitor Applications”.

17CEM04 - ENVORONMENT ECOLOGY			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES ANDOUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program
1.0	To impart knowledge on the basic knowledge about Environment and Ecology.	**1.1**	Differentiate the various ecosystem and effects of human activities on environment	**b,d,g**
2.0	To acquire knowledge on the natural resources and the energy produced.	**2.1**	Classify the types of natural resources and the sources of energy produced.	**f,g**
3.0	To get ideas on various environmental pollution and their effects.	**3.1**	Explain the environment issue based on environmental pollution.	**b,c,f**
4.0	To acquire knowledge on the various environment quality standards.	**4.1**	Apply the Environment Quality Standards according to pollution types.	**f,g**
5.0	To impart knowledge on the environment impact assessment for infrastructure projects.	**5.1**	Do the Environment Impact Assessment for infrastructure projects.	**b,c,g**

UNIT I - FUNDAMENTALS OF ENVIRONMENT AND ECOLOGY	**(9)**
Environment - Ecology and Ecosystem - Food chain - Food web - Trophic level - Energy flow - Introduction, types, characteristic features, structure and function - Forest - Grassland - Desert and Aquatic ecosystems - Effects of human activities on environment, Agriculture, Housing, Industry, Mining and Transportation.	
UNIT II - NATURAL RESOURCES	**(9)**
Water Resources - Mineral Resources - Soil, Material cycles - Carbon, Nitrogen and Sulphur Cycles - Energy - Different types of energy - Conventional and Non-Conventional sources - Hydro Electric. - Fossil Fuel based, Nuclear, Solar, Biomass and Geothermal energy and Bio-gas.	
UNIT III - ENVIRONMENTAL POLLUTION AND CURRENT ENVIRONMENTAL ISSUES OF IMPORTANCE	**(9)**
Concepts of Air Pollution, Water pollution, Land pollution, Noise pollution - Causes, effects and control measures - Climate Change and Global warming effects - Acid Rain, Ozone Layer depletion, Photochemical Smog - Solid waste management and Waste water treatment.	
UNIT IV - ENVIRONMENT QUALITY STANDARDS	**(9)**
Ambient air quality standards - Water quality parameters and standards - Turbidity, pH, Suspended solids, hardness, residual chlorine, sulphates, phosphates, iron and manganese, DO, BOD and COD - WHO and BIS norms.	
UNIT V - ENVIRONMENT IMPACT ASSESSMENT	**(9)**
Introduction to EIA - Screening, Scoping, Public Participation - EIA for infrastructure projects - Highways - Dams - Multi-storey Buildings - Water Supply and Drainage - Case studies.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Pandey SN and Misra SP, “Environment and Ecology”, Ane Books Pvt. Ltd, New Delhi, 2018.
2. P.D.Sharma, “Ecology and Environment”, Rastogi Publication, 2015.

REFERENCES:

1. Shukla, S.K. and Srivastava, P.R., “Concepts in Environmental Impact Analysis”, Common Wealth Publishers, New Delhi, 1992.
2. Canter, L.W., “Environmental Impact Assessment”, McGraw-Hill Inc., 1997.
3. S. S. Dara, “A Text Book of Environmental Chemistry & Pollution Control”, S. Chand and Co., 2004.
4. Samir K. Banerjee, “Environmental Chemistry”, Prentice Hall of India Pvt. Ltd. New Delhi, 2009.

17CEM05 - ENVIRONMENTAL HEALTH AND SAFETY				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES ANDOUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To understand and study the complexity of the environment in relation to pollutants generated due to industrial activity	**1.1**	Apply the concept of EHS and their framework.	**b,f,g**
2.0	To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.	**2.1**	Identify the monitoring principles in workplace systems.	**b,c,g**
3.0	Familiarisation on the concept of sustainable development and its benefits	**3.1**	Choose the need of training and methods of EHS	**f,g,h**
4.0	Recognize the potential of renewable energy sources and its conversion technologies for attaining sustainable development	**4.1**	Organize the safety auditing management systems and their prevention techniques.	**c,g,i**
5.0	Acquainting with energy policies and energy planning for sustainable development	**5.1**	Identify the key steps involved in HSE legislations.	**g,f,k**

UNIT I - OCCUPATION, SAFETY AND MANAGEMENT	**(9)**
Occupational Safety - Health and Environmental Safety Management - Principles & practices - Role of Management in Industrial Safety- Organization Behaviour - Human factors contributing to accident.	
UNIT II - MONITORING FOR SAFETY, HEALTH AND ENVIRONMENT	**(9)**
Bureau of Indian Standards on Safety and Health: 14489 - 1998 and 15001 - 2000 - ILO and EPA Standards - Principles of Accident - Prevention - Definitions - Incident - accident - injury - dangerous - occurrences - unsafe acts - unsafe conditions - hazards - error - oversight - mistakes.	
UNIT III - EDUCATION, TRAINING AND EMPLOYEE PARTICIPATION IN SAFETY	**(9)**
Element of training cycle - Techniques of training, design and development of training programs - Training methods and strategies types of training - Competence Building Techniques (CBT) - Employee Participation: Purpose - methods - Role of trade union in SHE.	
UNIT IV - MANAGEMENT INFORMATION SYSTEM	**(9)**
Sources of information on Safety, Health and Environment - Compilation and collation of information - Analysis & use of modern methods of programming - storing and retrieval of MIS for Safety, Health and Environment - QCC HS Computer Software Application and Limitations.	
UNIT V - LEGISLATION ON SAFETY, HEALTH AND ENVIRONMENT	**(9)**
Overview of SHE - The factories act, 1948 (Amended) and Rules - Contract Labour Act - Social Accountability - SA 8000 - Water(Prevention and Control of Pollution) Act 1974 and Rules - Air (Prevention & Control of Pollution) Act 1981 and Rules - Environment Protection Act.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. Narayanan K.T., "Safety, Health and Environment Handbook", 1st Edition, McGraw Hill, New Delhi, 2017.

REFERENCES:

1. Nicholas P.Cheremisinoff & Madelyn L.Graffia, "Environmental and Health & Safety Management- A Guide to Compliance", 1st ed., William Andrew Publisher, Norwich, 1995.
2. David Yates W., "Safety Professional's Reference & Study Guide", 2nd ed., CRC Press Publishers, New Delhi, 2015.

17CEM06 - INTRODUCTION TO SMART CITIES			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES ANDOUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To help the learners to understand the concepts of smart city and to introduce the students about application of technologies in smart cities	**1.1**	Discuss the importance, features and case histories of smart cities in India	**e,f,l,j**
2.0	To understand the basics of Urbanisation and the role of smart cities	**2.1**	Describe mobility and energy in smart city	**e,f**
3.0	To Understand the role of smart planning for sustainable development.	**3.1**	Explain water and waste management techniques in smart city	**e,h,j,k**
4.0	To Gain knowledge on implementation of smart physical infrastructure.	**4.1**	Model smart environment and smart buildings	**b,c,g,i**
5.0	To Comprehend knowledge of Technologies in Smart City planning	**5.1**	Plan e-governance and ICT in smart city	**e,f,g,k**

UNIT I - INTRODUCTION	**(9)**
Definitions - Evolution - Features and strategies - Challenges - India 100 smart cities policy and mission, smart city planning and development, financing smart cities development. Governance of smart cities - case studies in India.	
UNIT II - SMART URBAN MOBILITY AND SMART ENERGY	**(9)**
Need for urban mobility - multiple perspectives - objectives - components - emerging concepts and strategies - ICT supported smart mobility systems - policy priorities. Introduction to smart energy - urban density and energy use - objectives - elements of smart energy management system - strategies - smart grid - challenges.	
UNIT III - WATER AND WASTE MANAGEMENT	**(9)**
Smart water management - definitions - water resource and cycle - functions and objectives - steps in implementation - benefits - policy challenges. Smart waste management - approaches and implementation - existing systems - strategies - challenges and polices.	
UNIT IV - SMART ENVIRONMENT AND SMART BUILDINGS	**(9)**
Global background of environmental concerns - concept of environmental resources - basic environmental challenges - smart environment - stakeholders - ICT framework for environmental management. Intelligent buildings - objectives - components - systems of smart building – benefits, challenges.	
UNIT V - E- GOVERNANCE AND ICT	**(9)**
Governance challenges in new era - history of smart governance - functions and objectives - ICT in governance - system infrastructure - benefits, challenges and future vision. Taxonomy of layers of ICT architecture - major technology areas - components - emerging technologies in ICT - challenges and concerns in ICT.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Anilkumar P.P, "Introduction to Smart Cities", 1st ed., Pearson India Education Service Pvt Ltd, Noida,Uttar Pradesh, India, 2019.
2. P Sharma , “Sustainable Smart cities in India, Challenges and Future Perspectives”, Springer Link, 2017
3. Sameer Sharma, “Smart Cities Unbounded- Ideas and Practice of Smart Cities in India”, Bloomsbury India, 2018.

REFERENCES:

1. Germaine R. Halegoua, "Smart Cities", 1st ed., The MIT Press Essential Knowledge Series, London, England, 2020.
2. Andy Pike, Andres Rodriguez-Pose & John Tomaney, "Handbook of Local and Regional Development", 3rd ed., Taylor Francis, United Kingdom, 2010.
3. Binti Singh, ManojParmar, “Smart City in India Urban Laboratory, Paradigm or Trajectory”, Routledge India,2019

17CEM07 - DISASTER PREPAREDNESS AND PLANNING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES ANDOUTCOMES					
Course Objectives		**Course Outcomes** The students will be able to			**Related Program Outcomes**
1.0	To impart knowledge on the key concepts in disaster risk reduction and humanitarian response	**1.1**	Explain different forms of disaster and their causes		**g,k**
2.0	To impart knowledge on the impact and effects of earthquakes and tsunami	**2.1**	Identify the causes, effects and precautionary measures of earthquakes and tsunami		**f,g**
3.0	To impart knowledge on the effects of floods and droughts	**3.1**	Identify the causes and control measures of flood and droughts		**b,c,e,j**
4.0	To acquaint with the skills for planning and organizing disaster response	**4.1**	Choose suitable remedial measures for slope stabilization		**d,f**
5.0	To acquire knowledge on disaster risk reduction	**5.1**	Develop a disaster management cycle with disaster risk reduction measures		**d,g**

UNIT I - INTRODUCTION TO DISASTERS	**(9)**
Definition - Disaster, Hazard, Vulnerability, Resilience, Risks - Disasters: Types of disasters - Earthquake, Landslide, Flood, Drought, Fire, Forest Fire, Industrial and Technological Disasters, Climate Change- Classification, Causes, Impacts - Do's and Don'ts during disaster - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change	
UNIT II - EARTHQUAKES AND TSUNAMI	**(9)**
Earthquakes - causes of earthquakes - effects - plate tectonics - seismic waves - measures of size of earthquakes - earthquake resistant design concepts. Tsunami - causes - effects - undersea earthquakes - landslides - volcanic eruptions - impact of sea meteorite - remedial measures - precautions - case studies.	
UNIT III - FLOODS AND DROUGHTS	**(9)**
Climatic Hazards - Floods - causes of flooding - regional flood frequency analysis - flood control measures - flood routing - flood forecasting - warning systems. Droughts - causes - types of droughts - effects of drought - mitigation - case studies.	
UNIT IV - LANDSLIDES AND SLOPE STABILITY: MANAGEMENT	**(9)**
Landslides - Causes - Principles of stability analysis - Remedial and corrective measures for slope stabilization - mitigation - cause studies.	
UNIT V - DISASTER PREPAREDNESS AND MANAGEMENT	**(9)**
Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness. NDLA, National Disaster Management.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Singhal J.P., "Disaster Management", 1st ed., Laxmi Publications, India, 2007
2. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, Issues and Strategies”, 1st ed. New Royal book Company,2007.

REFERENCES:

1. Gupta M.C., "Manual on Natural Disaster Management in India", NIDM, New Delhi, 2000.
2. "National Disaster Management Policy", Government of India, 2009

17CEM08 - ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES ANDOUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program Outcomes
1.0	To understand the types of energy sources, energy efficiency and environmental implications of energy utilisation	**1.1**	Relate the prevailing energy scenario	**b,d**
2.0	To create awareness on energy audit and its impacts	**2.1**	Familiarise on energy audits and its relevance	**g,i,k**
3.0	To acquaint the techniques adopted for performance evaluation of thermal utilities	**3.1**	Apply the concept of energy audit on thermal utilities	**f,i**
4.0	To familiarise on the procedures adopted for performance evaluation of electrical utilities	**4.1**	Employ relevant techniques for energy improvement in electrical utilities	**c,f,l,k**
5.0	To learn the concept of sustainable development and the implication of energy usage	**5.1**	Realize Sustainable development and its impact on human resource development	**a,d,g**

UNIT I - ENERGY AND ENVIRONMENT	**(9)**
Primary energy sources - Coal, Oil, Gas - India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP	
UNIT II - ENERGY AUDITING	**(9)**
Need and types of energy audit. Energy management (audit) approach - understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments	
UNIT III - ENERGY EFFICIENCY IN THERMAL UTILITIES	**(9)**
Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermo compression	
UNIT IV - ENERGY CONSERVTION IN ELECTRICAL UTILITIES	**(9)**
Demand side management - Power factor improvement - Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers	
UNIT V - SUSTAINABLE DEVELOPMENT	**(9)**
Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG). Globalization and Economic growth. Economic development: Economic inequalities, Income and growth. Social development: Poverty, conceptual issues and measures, impact of poverty	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Pratap Bhattacharyya, “Climate Change and Greenhouse Gas Emission”, New India Publishing Agency- Nipa,2020
2. Matthew John Franchetti , Defne Apul “Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies” CRC Press,2012
3. Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, “Energy and the Environment”, 4th ed.,Wiley,2022

REFERENCES:

1. Energy Manager Training Manual (4 Volumes) available at http://www.em-ea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004
2. Eastop.T.D& Croft D.R, “Energy Efficiency for Engineers and Technologists”, Logman Scientific & Technical, 1990
3. W.R. Murphy and G. McKay “Energy Management” Butterworths, London 1987