`

SRI SHAKTHI

INSTITUTE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University)
Coimbatore – 62.

VISION AND MISSION OF THE INSTITUTION

VISION:

To make the institution one of our nation's great engineering schools, recognized nationally and internationally for excellence in teaching, research and public service. We seek to be the preferred destination for students, practitioners seeking an engineering education, employers hiring engineering graduates and organizations seeking engineering knowledge.

MISSION:

To Provide an encouraging environment to develop the intellectual capacity, critical thinking, creativity and problem solving ability of the students.

VISION AND MISSION OF THE DEPARTMENT

VISION:

The Civil Engineering Department will excel in undergraduate and postgraduate instruction, research in all sub areas of civil engineering, and in service to the public consistent with the land-grant mission of the college. The Department will make significant contributions to the economic development of the state, region and nation.

MISSION:

The mission of the Department of Civil Engineering is to:

- Provide quality education to prepare nationally competitive undergraduate students for a successful career in civil engineering.
- Provide advanced skills and knowledge in state-of-the-art research and design in sub-areas of civil engineering for graduate students.
- Provide service to the engineering profession, and the public.

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SRI SHAKTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, COIMBATORE
(AUTONOMOUS)
B.E. CIVIL ENGINEERING
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES:

Graduates can,

PEO1	:	To develop the confidence and ability among students to synthesize data and technical concepts and thereby apply it in real world problems.
PEO2	:	To solve civil engineering problems in different scenarios there by making them successful in engineering practice and/or research or in other fields they choose to pursue.
PEO3	:	To achieve expertise in design and analysis of various civil engineering structures.
PEO4	:	To promote students to work collaboratively on multi-disciplinary projects and make them engage in life-long learning process throughout their professional life.
PEO5	:	To function ethically in professional civil engineering roles and exhibit good competency in their work culture.

2. PROGRAMME OUTCOMES:

Engineering Graduates will be able to,

PO1	a	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	b	**Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	c	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	d	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	e	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	f	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	g	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	h	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	i	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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PO10	j	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	k	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	l	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

3. PROGRAM SPECIFIC OBJECTIVES (PSOs):

The students will be able to,

PSO1	:	To Establish a Civil Engineering career in industry, government or academic field and achieve professional expertise as appropriate.
PSO2	:	To Execute innovation and excellence in Civil engineering problem solving and design in global and societal contexts
PSO3	:	Commit to lifelong learning and professional development in the Civil Engineering field to stay updated in technology, research topics and contemporary issues.

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	3	3	2		2					1	1
2	3	3	3	3					2			1
3	3	3	1		1	3	2				2	
4	3	3	3	2	3	2		1	1			2
5			2			2		3	2	2	2	

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

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

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MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

A broad relation between the Course Outcomes and Programme Outcomes is given in the following table

COURSE OUTCOMES		PROGRAMME OUTCOMES											
Sem	**Course Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
I	Communicative English						✓	✓	✓	✓	✓		✓
	Matrices, Solid Geometry and Calculus for Civil Engineering	✓	✓	✓	✓	✓					✓		✓
	Applied physics for Civil Engineering	✓	✓										
	Computational Thinking and Problem Solving	✓	✓	✓	✓	✓				✓		✓	✓
	Introduction to Civil Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Engineering Graphics	✓	✓	✓	✓	✓	✓			✓			✓
	Language - Tamil						✓	✓	✓	✓	✓		✓
	Language – Malayalam							✓	✓	✓	✓		✓
	Language – Foundation English							✓	✓	✓	✓		✓
	Engineering Exploration - I	✓	✓	✓	✓	✓	✓				✓	✓	
	Crop Production Laboratory	✓	✓		✓	✓	✓	✓					
	Communicative English Laboratory						✓	✓	✓	✓	✓		✓
	Applied physics for Civil Engineering Laboratory	✓	✓	✓	✓							✓	
	Computational Thinking and Problem Solving Laboratory	✓	✓	✓	✓	✓				✓		✓	✓
	Introduction to Civil Engineering Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Engineering Graphics Laboratory	✓		✓	✓	✓		✓	✓			✓	
II	English for Engineers						✓	✓	✓	✓	✓		✓
	Advanced calculus	✓	✓	✓	✓	✓				✓			✓
	Environmental Engineering						✓	✓					
	C Programming	✓	✓	✓	✓	✓							
	Engineering Mechanics	✓	✓	✓	✓		✓			✓	✓		✓
	Building Planning and Architecture	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Engineering Exploration – II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	English for Engineers Laboratory						✓	✓	✓	✓	✓		✓
	Environmental Engineering Laboratory	✓	✓	✓			✓	✓					
	C Programming Laboratory	✓	✓	✓	✓	✓							

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	Building Planning and Architecture Laboratory	✓	✓	✓	✓	✓	✓		✓		✓		✓
III	Probability, Statistics and Optimization Techniques	✓	✓	✓	✓	✓							✓
	Mechanics of Materials	✓	✓	✓	✓		✓						✓
	Fluid Mechanics	✓	✓	✓	✓	✓					✓		✓
	Surveying	✓	✓	✓	✓	✓	✓			✓	✓		✓
	Construction Materials	✓	✓	✓		✓		✓					✓
	Engineering geology	✓	✓	✓		✓	✓	✓					✓
	Engineering Exploration – III	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mechanics of Materials Laboratory	✓	✓	✓	✓	✓		✓		✓			✓
	Fluid Mechanics Laboratory	✓	✓	✓	✓	✓				✓	✓		✓
	Surveying Laboratory	✓	✓	✓	✓	✓				✓	✓		✓
	Construction Materials Laboratory	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓
	Engineering Geology Laboratory	✓	✓	✓	✓	✓						✓	✓
	Career Enhancement Program – I	✓	✓				✓	✓	✓	✓	✓		✓
IV	Numerical methods for Civil Engineering	✓	✓	✓	✓	✓							✓
	Strength of Materials	✓	✓	✓	✓	✓	✓				✓		✓
	Applied Hydraulic Engineering	✓	✓	✓	✓	✓		✓			✓		✓
	Construction Practises	✓	✓	✓	✓	✓	✓				✓		✓
	Soil Mechanics	✓	✓	✓	✓	✓		✓					✓
	Engineering Exploration – IV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Drafting 2D and 3D Models using Auto CAD Laboratory	✓	✓	✓									✓
	Strength of Materials Laboratory	✓	✓	✓	✓	✓	✓			✓			✓
	Applied Hydraulic Engineering Laboratory	✓	✓	✓	✓		✓	✓			✓		✓
	Construction Practices Laboratory	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓
	Soil Mechanics Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Career Enhancement Program – II	✓	✓				✓	✓	✓	✓	✓		✓
V	Design of Reinforced Concrete Element	✓	✓	✓	✓	✓		✓			✓		✓
	Structural Analysis – I	✓	✓	✓	✓		✓				✓	✓	✓
	Foundation Engineering	✓	✓	✓			✓				✓		✓
	Highway Engineering	✓	✓	✓	✓						✓		✓
	Concrete Technology	✓	✓	✓	✓	✓	✓	✓			✓		✓
	Professional Elective - I												
	Engineering Exploration – V	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Structural Analysis Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
	Highway Engineering Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Concrete Technology Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓

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	Survey Camp (2weeks during IV semester)	✓		✓	✓	✓	✓		✓	✓	✓		✓
	Career Enhancement Program – III		✓	✓				✓	✓		✓	✓	
VI	Design of Steel Structures	✓	✓	✓	✓	✓		✓			✓	✓	✓
	Structural Analysis – II	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓
	Water and Waste Water Engineering	✓	✓	✓	✓			✓					✓
	Railway Engineering	✓	✓	✓	✓		✓	✓		✓			✓
	Professional Elective – II												
	Open Elective - I												
	Design Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Design of steel structures Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
	Water and waste water Engineering Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Career Enhancement Program – IV		✓	✓				✓	✓		✓	✓	
VII	Design of Prestressed Concrete Elements	✓	✓	✓	✓			✓			✓		✓
	Estimation Costing and Valuation Engineering	✓	✓	✓			✓				✓		✓
	Construction Planning and Management	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
	Professional Elective – III												
	Open Elective - II												
	Project Work Phase – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Estimation and Quantity Surveying Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
	Industrial Training	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
VIII	Professional Elective – IV												
	Professional Elective – V												
	Project Work Phase – II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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I - VIII SEMESTER CURRICULA AND SYLLABI

SEMESTER I

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
THEORY								
I	U19ENTL101T	Communicative English	HS	2	2	0	0	2
I	U19MATH104	Matrices, Solid Geometry and Calculus for Civil Engineering	BS	4	3	1	0	4
I	U19PHTL103T	Applied physics for Civil Engineering	BS	2	2	0	0	2
I	U19CSTL101T	Computational Thinking and Problem Solving	ES	3	3	0	0	3
I	U19CETL101T	Introduction to Civil Engineering	PC	2	2	0	0	2
I	U19CETL102T	Engineering Graphics	ES	2	2	0	0	2
I	U19LATH101 U19LATH102 U19LAEN101	Language - Tamil Language - Malayalam Foundation - English	HS	2	2	0	0	2
LABORATORY								
I	U19CCEX101	Engineering Exploration – I	EEC	2	1	0	2	2
I	U19AEPC101	Crop Production Laboratory	BS	4	0	0	4	2
I	U19ENTL101L	Communicative English Laboratory	HS	2	0	0	2	1
I	U19PHTL103L	Applied physics for Civil Engineering Laboratory	BS	2	0	0	2	1
I	U19CSTL101L	Computational Thinking and Problem-Solving Laboratory	ES	2	0	0	2	1
I	U19CETL101L	Introduction to Civil Engineering Laboratory	PC	2	0	0	2	1
I	U19CETL102L	Engineering Graphics Laboratory	PC	2	0	0	2	1
Total Credits (Semester)				**33**	**17**	**1**	**16**	**26**

SEMESTER II

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
THEORY								
II	U19ENTL202T	English for Engineers	HS	2	2	0	0	2
II	U19MATH213	Advanced calculus	BS	4	3	1	0	4
II	U19CHTL205T	Environmental Engineering	BS	3	3	0	0	3
II	U19CSTL203T	C Programming	ES	3	3	0	0	3
II	U19CETH203	Engineering Mechanics	ES	3	3	0	0	3
II	U19CETL204T	Building Planning and Architecture	PC	2	2	0	0	2
LABORATORY								
II	U19CCEX202	Engineering Exploration – II	EEC	3	1	0	2	2
II	U19ENTL202L	English for Engineers Laboratory	HS	2	0	0	2	1
II	U19CHTL205L	Environmental Engineering Laboratory	BS	2	0	0	2	1
II	U19CSTL203L	C Programming Laboratory	ES	2	0	0	2	1
II	U19CETL204L	Building Planning and Architecture Laboratory	PC	2	0	0	2	1
Total Credits (Semester)				**28**	**17**	**1**	**10**	**23**

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SEMESTER III

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
THEORY								
III	U19MATH321	Probability, Statistics and Optimization Techniques	BS	4	3	1	0	4
III	U19CETL305T	Mechanics of Materials	PC	3	3	0	0	3
III	U19CETL306T	Fluid Mechanics	PC	2	2	0	0	2
III	U19CETL307T	Surveying	PC	2	2	0	0	2
III	U19CETL308T	Construction Materials	PC	2	2	0	0	2
III	U19CETL309T	Engineering geology	ES	2	2	0	0	2
LABORATORY								
III	U19CCEX303	Engineering Exploration – III	EEC	2	0	0	2	1
III	U19CETL305L	Mechanics of Materials Laboratory	PC	2	0	0	2	1
III	U19CETL306L	Fluid Mechanics Laboratory	PC	2	0	0	2	1
III	U19CETL307L	Surveying Laboratory	PC	2	0	0	2	1
III	U19CETL308L	Construction Materials Laboratory	PC	2	0	0	2	1
III	U19CETL309L	Engineering Geology Laboratory	ES	2	0	0	2	1
III	U19CCLC301	Career Enhancement Program – I	EEC	2	1	1	0	1
Total Credits (Semester)				**29**	**15**	**1**	**12**	**22**

SEMESTER IV

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
THEORY								
IV	U19MATH428	Numerical methods for Civil Engineering	BS	3	3	0	0	3
IV	U19CETL410T	Strength of Materials	PC	3	3	0	0	3
IV	U19CETL411T	Applied Hydraulic Engineering	PC	3	3	0	0	3
IV	U19CETL412T	Construction Practises	PC	2	2	0	0	2
IV	U19CETL413T	Soil Mechanics	PC	3	3	0	0	3
LABORATORY								
IV	U19CCEX404	Engineering Exploration – IV	EEC	2	0	0	2	1
IV	U19CELC414	Drafting 2D and 3D Models using Auto CAD Laboratory	PC	4	0	0	4	2
IV	U19CETL410L	Strength of Materials Laboratory	PC	2	0	0	2	1
IV	U19CETL411L	Applied Hydraulic Engineering Laboratory	PC	2	0	0	2	1
IV	U19CETL412L	Construction Practices Laboratory	PC	2	0	0	2	1
IV	U19CETL413L	Soil Mechanics Laboratory	PC	2	0	0	2	1
IV	U19CCLC402	Career Enhancement Program – II	EEC	2	0	0	2	1
Total Credits (Semester)				**30**	**14**	**0**	**16**	**22**

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SEMESTER V

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
THEORY								
V	U19CETH501	Design of Reinforced Concrete Element	PC	4	3	1	0	4
V	U19CETL516T	Structural Analysis – I	PC	5	3	0	0	3
V	U19CETH502	Foundation Engineering	PC	3	3	0	0	3
V	U19CETL518T	Highway Engineering	PC	3	3	0	0	3
V	U19CETL519T	Concrete Technology	PC	3	3	0	0	3
V		Professional Elective – I	PE	3	3	0	0	3
LABORATORY								
V	U19CCEX505	Engineering Exploration - V	EEC	2	0	0	2	1
V	U19CETL516L	Structural Analysis Laboratory	PC	2	0	0	2	1
V	U19CETL518L	Highway Engineering Laboratory	PC	2	0	0	2	1
V	U19CETL519L	Concrete Technology Laboratory	PC	2	0	0	2	1
V	U19CEIV501	Survey Camp (2weeks during IV semester)	EEC	0	0	0	0	2
V	U19CCLC503	Career Enhancement Program – III	EEC	2	0	0	2	1
Total Credits (Semester)				**31**	**18**	**1**	**10**	**26**

SEMESTER VI

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
THEORY								
VI	U19CETL620T	Design of Steel Structures	PC	4	3	1	0	4
VI	U19CETH604	Structural Analysis – II	PC	3	3	0	0	3
VI	U19CETL621T	Water and Waste Water Engineering	PC	3	3	0	0	3
VI	U19CETH605	Railway Engineering	PC	3	3	0	0	3
VI		Professional Elective – II	PE	3	3	0	0	3
VI		Open Elective - I	PE	3	3	0	0	3
LABORATORY								
VI	U19CEPR601	Design Project	EEC	4	0	0	4	2
VI	U19CETL620L	Design of steel structures Laboratory	PC	2	0	0	2	1
VI	U19CETL621L	Water and Waste Water Engineering Laboratory	PC	0	0	0	2	1
VI	U19CCLC604	Career Enhancement Program – IV	EEC	2	0	0	2	1
Total Credits (Semester)				**27**	**18**	**1**	**10**	**24**

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SEMESTER VII

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
THEORY								
VII	U19CETH706	Design of Prestressed Concrete Elements	PC	3	3	0	0	3
VII	U19CETL722T	Estimation Costing and Valuation Engineering	PC	3	3	0	0	3
VII	U19CETH707	Construction Planning and Management	PC	3	3	0	0	3
VII		Professional Elective – III	PE	3	3	0	0	3
VII		Open Elective - II	OE	3	3	0	0	3
LABORATORY								
VII	U19CEPR702	Project Work Phase – I	EEC	4	0	0	4	2
	U19CETL722L	Estimation and Quantity Surveying Laboratory	PC	2	0	0	2	1
VII	U19CEIV702	Industrial Training (4 Weeks during VI Semester Vacation)	EEC	0	0	0	0	1
Total Credits (Semester)				**21**	**15**	**0**	**6**	**19**

SEMESTER VIII

Semester	Course Code	Course Title	Category	Contact Period	L	T	P	C
THEORY								
VIII		Professional Elective – IV	PC	3	3	0	0	3
VIII		Professional Elective – V	PC	3	3	0	0	3
LABORATORY								
VIII	U19CEPR803	Project Work Phase – II	EEC	12	0	0	12	6
Total Credits (Semester)				**18**	**6**	**0**	**12**	**12**

Total Credits - 174

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HUMANITIES AND SCIENCES (HS)

S.No	Course Code	Course Title	Category	Contact Period	L	T	P	C
1.	U19ENTL101T	Communicative English	HS	2	2	0	0	2
2.	U19ENTL101L	Communicative English Laboratory	HS	2	0	0	2	1
2.	U19LATH101	Language – Tamil	HS	2	2	0	0	2
3.	U19LATH102	Language - English						
5.	U19LAEN101	Foundation English						
6.	U19ENTL202T	English for Engineers	HS	2	2	0	0	2
7.	U19ENTL202L	English for Engineers Laboratory	HS	2	0	0	2	1

BASIC SCIENCES (BS)

S.No	Course Code	Course Title	Category	Contact Period	L	T	P	C
1.	U19MATH104	Matrices, Solid geometry and Calculus	BS	4	3	1	0	4
2.	U19PHTL103T	Applied physics for Civil Engineering	BS	2	2	0	0	2
3.	U19PHTL104L	Applied physics for Civil Engineering Laboratory	BS	2	0	0	2	1
3.	U19AEPC101	Crop Production Laboratory	BS	3	0	0	3	2
4.	U19CHTL205T	Environmental Engineering	BS	3	3	0	0	3
5.	U19CHTL205L	Environmental Engineering Laboratory	BS	2	0	0	2	1
5.	U19MATH213	Advanced calculus	BS	4	3	1	0	4
6.	U19MATH322	Probability, Statistics and Optimization Techniques	BS	4	3	1	0	4
7.	U19MATH432	Numerical methods for civil engineering	BS	3	3	0	0	3

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ENGINEERING SCIENCES (ES)

S.No	Course Code	Course Title	Category	Contact Period	L	T	P	C
1.	U19CSTL101T	Computational Thinking and Problem Solving	ES	3	3	0	0	3
2.	U19CSTL101L	Computational Thinking and Problem-Solving Laboratory	ES	2	0	0	2	1
3.	U19CETL102T	Engineering Graphics	ES	3	3	0	0	3
4.	U19CETL102L	Engineering Graphics Laboratory	ES	2	0	0	2	1
5.	U19CSTL203T	C Programming	ES	3	3	0	0	3
6.	U19CSTL203L	C Programming Laboratory	ES	2	0	0	2	1
7.	U19CETH203	Engineering Mechanics	ES	3	3	0	0	3
8.	U19CETL309T	Engineering geology	ES	2	2	0	0	0
9.	U19CETL309L	Engineering geology Laboratory	ES	2	0	0	2	1

PROFESSIONAL CORE

S.No	Course Code	Course Title	Category	Contact Period	L	T	P	C
1.	U19CETL101T	Introduction to Civil Engineering	PC	2	2	0	0	2
2.	U19CETL101L	Introduction to Civil Engineering Laboratory	PC	2	0	0	2	1
3.	U19CETL204T	Building Planning & Architecture	PC	2	2	0	0	2
4.	U19CETL204L	Building Planning and Architecture Laboratory	PC	2	0	0	2	1
5.	U19CETL305T	Mechanics of Material	PC	3	3	0	0	3
6.	U19CETL306T	Fluid Mechanics	PC	2	2	0	0	2
7.	U19CETL307T	Surveying	PC	2	2	0	0	2
8.	U19CETL308T	Construction Materials	PC	2	2	0	0	2
9.	U19CETL305L	Mechanics of Materials Laboratory	PC	2	0	0	2	1
10.	U19CETL306L	Fluid Mechanics Laboratory	PC	2	0	0	2	1
11.	U19CETL307L	Surveying Laboratory	PC	2	0	0	2	1
12.	U19CETL308L	Construction Materials Laboratory	PC	2	0	0	2	1
13.	U19CETL410T	Strength of Materials	PC	3	3	0	0	3
14.	U19CETL411T	Applied Hydraulic Engineering	PC	3	3	0	0	3
15.	U19CETH412T	Construction Practises	PC	2	2	0	0	2
16.	U19CETL413T	Soil Mechanics	PC	2	2	0	0	2
17.	U19CETL410L	Strength of Materials Laboratory	PC	2	0	0	2	1
18.	U19CETL411L	Applied Hydraulic Engineering Laboratory	PC	2	0	0	2	1

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19.	U19CETL412L	Construction Practises Laboratory	PC	2	0	0	2	1
20.	U19CETL413L	Soil Mechanics Laboratory	PC	2	0	0	2	1
21.	U19CELC414	Drafting 2D and 3D Models using Auto CAD Laboratory	PC	5	1	0	4	2
22.	U19CETH501	Design of Reinforced Concrete Elements	PC	4	3	0	1	4
23.	U19CETL516T	Structural Analysis – 1	PC	3	3	0	0	3
24.	U19CETH502	Foundation Engineering	PC	3	3	0	0	3
25.	U19CETL518T	Highway Engineering	PC	3	3	0	0	3
26.	U19CETL519T	Concrete Technology	PC	3	3	0	0	3
27.	U19CETL516L	Structural Analysis Laboratory	PC	2	0	0	2	1
28.	U19CETL518L	Highway Engineering Laboratory	PC	2	0	0	2	1
29.	U19CETL519L	Concrete Technology Laboratory	PC	2	0	0	2	1
30.	U19CETL620T	Design of steel structures	PC	4	2	0	2	4
31.	U19CETH604	Structural Analysis – II	PC	4	2	0	2	3
32.	U19CETL621T	Water and waste water engineering	PC	3	3	0	0	3
33.	U19CETH605	Railway Engineering	PC	4	3	0	0	3
34.	U19CETL620L	Design of Steel Structures Laboratory	PC	2	0	0	2	1
35.	U19CETL621L	Water and Waste Water Analysis Laboratory	PC	2	0	0	2	1
36.	U19CETH706	Design of Prestressed Concrete Elements	PC	3	3	0	0	3
37.	U19CETL722T	Estimation Costing and Valuation Engineering	PC	2	2	0	0	2
38.	U19CETL722L	Estimation and Quantity Surveying Laboratory	PC	2	0	0	2	1
39.	U19CETH707	Construction Planning and Management	PC	3	3	0	0	3

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No	Course Code	Course Title	Category	Contact Period	L	T	P	C
1.	U19CCEX101	Engineering Exploration – I	EEC	3	1	0	2	2
2.	U19CCEX202	Engineering Exploration – II	EEC	3	1	0	2	2
3.	U19CCEX303	Engineering Exploration – III	EEC	2	0	0	2	1
4.	U19CCLC301	Career Enhancement Program – I	EEC	2	1	1	0	1
5.	U19CCEX404	Engineering Exploration – IV	EEC	2	0	0	2	1
6.	U19CCLC402	Career Enhancement Program – II	EEC	2	1	1	0	1
7.	U19CCEX505	Engineering Exploration - V	EEC	2	0	0	2	1
8.	U19CCLC503	Career Enhancement Program – III	EEC	2	1	1	0	1
9.	U19CEIV501	Survey Camp	EEC	2	0	0	2	1
10.	U19CEPR601	Design Project	EEC	4	0	0	4	2
11.	U19CCLC605	Career Enhancement Program – IV	EEC	2	1	1	0	1
12.	U19CEPR702	Project Work Phase – I	EEC	4	0	0	4	2
13.	U19CEIV702	Industrial Training	EEC	0	0	0	0	2
14.	U19CEPR803	Project Work Phase – II	EEC	12	0	0	12	6

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PROFESSIONAL ELECTIVES

S.No	Course Code	Course Title	Category	Contact Period	L	T	P	C	Pre - Requisite
Professional Elective - I									
1.	U19CEPE001	Total Station and GPS Surveying	PE	3	3	0	0	3	Nil
2.	U19CEPE002	Irrigation Engineering	PE	3	3	0	0	3	Nil
3.	U19CEPE003	Urban Planning and Development	PE	3	3	0	0	3	Nil
4.	U19CEPE004	Human Rights	PE	3	3	0	0	3	Nil
5.	U19CEPE005	Remote Sensing and GIS	PE	3	3	0	0	3	Nil
Professional Elective - II									
6.	U19CEPE006	Prefabricated Structures	PE	3	3	0	0	3	Nil
7.	U19CEPE007	Ground Improvement techniques	PE	3	3	0	0	3	Nil
8.	U19CEPE008	Disaster Management	PE	3	3	0	0	3	Nil
9.	U19CEPE009	Municipal Solid Waste Management	PE	3	3	0	0	3	Nil
10.	U19CEPE010	Geoinformatics Application for Civil Engineers	PE	3	3	0	0	3	Nil
Professional Elective - III									
11.	U19CEPE011	Internet of Things in Civil Engineering	PE	3	3	0	0	3	Nil
12.	U19CEPE012	Bridge Engineering	PE	3	3	0	0	3	Nil
13.	U19CEPE013	Ground water Engineering	PE	3	3	0	0	3	Nil
14.	U19CEPE014	Professional ethics in Engineering	PE	3	3	0	0	3	Nil
15.	U19CEPE015	Traffic Engineering and Management	PE	3	3	0	0	3	Nil
Professional Elective - IV									
16.	U19CEPE016	Structural Design	PE	3	3	0	0	3	Nil
17	U19CEPE017	Environmental and Social Impact Assessment	PE	3	3	0	0	3	Nil
18.	U19CEPE018	Pavement Engineering	PE	3	3	0	0	3	Nil
19.	U19CEPE019	Hydrology and Water resource Management	PE	3	3	0	0	3	Nil
20.	U19CEPE020	Total Quality Management	PE	3	3	0	0	3	Nil
Professional Elective - V									
21.	U19CEPE021	Basics of Dynamics and Seismic Design of Structures	PE	3	3	0	0	3	Nil
22.	U19CEPE022	Maintenance Repair and Rehabilitation of Structures	PE	3	3	0	0	3	Nil

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23.	U19CEPE023	Intellectual Property rights	PE	3	3	0	0	3	Nil
24.	U19CEPE024	Introduction to Finite Element Method	PE	3	3	0	0	3	Nil
25.	U19CEPR025	Rock Engineering	PE	3	3	0	0	3	Nil

OPEN ELECTIVE

ELECTIVE – I

S.No	Course Code	Course Title	Category	Contact Period	L	T	P	C	Pre – Requisite
1.	U19AEOE001	Agricultural Waste Management	OE	3	3	0	0	3	Nil
2.	U19AEOE002	Farm Management	OE	3	3	0	0	3	Nil
3.	U19BTOE001	Basics of Bioinformatics	OE	3	3	0	0	3	Nil
4.	U19BTOE002	Introduction to Bio Energy and Bio Fuels	OE	3	3	0	0	3	Nil
5.	U19BMOE001	Bio Health Care and Telemedicine	OE	3	3	0	0	3	Nil
6.	U19BMOE002	Embedded Systems in Medical Devices	OE	3	3	0	0	3	Nil
7.	U19CEOE001	Green Buildings	OE	3	3	0	0	3	Nil
8.	U19CEOE002	Disaster Preparedness and Management	OE	3	3	0	0	3	Nil
9.	U19CSOE001	Software Engineering	OE	3	3	0	0	3	Nil
10.	U19CSOE002	Database Management System	OE	3	3	0	0	3	Nil
11.	U19ECOE001	Soft Computing	OE	3	3	0	0	3	Nil
12.	U19ECOE002	Medical Electronics	OE	3	3	0	0	3	Nil
13.	U19EEOE001	Renewable Energy Resources	OE	3	3	0	0	3	Nil
14.	U19EEOE002	Introduction to Control Systems	OE	3	3	0	0	3	Nil
15.	U19FTOE001	Food Science and Nutrition	OE	3	3	0	0	3	Nil
16.	U19FTOE002	Food Preservation Techniques	OE	3	3	0	0	3	Nil
17.	U19ITOE001	UX/UI Design	OE	3	3	0	0	3	Nil
18.	U19ITOE002	Multimedia Systems	OE	3	3	0	0	3	Nil
19.	U19MEOE001	Engineering Drawing	OE	3	3	0	0	3	Nil
20.	U19MEOE002	Modern Manufacturing Techniques	OE	3	3	0	0	3	Nil
21.	U19PHOE001	Nanotechnology and Engineering	OE	3	3	0	0	3	Nil
22.	U19ENOE001	English for Competitive Exams	OE	3	3	0	0	3	Nil

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ELECTIVE – II

S.No	Course Code	Course Title	Category	Contact Period	L	T	P	C	Pre – Requisite
1.	U19AEOE003	Introduction to Bio Energy	OE	3	3	0	0	3	Nil
2.	U19AEOE004	Robotics in Agriculture	OE	3	3	0	0	3	Nil
3.	U19BTOE003	Analytical Methods and Instrumentation	OE	3	3	0	0	3	Nil
4.	U19BTOE004	Industrial Waste Management	OE	3	3	0	0	3	Nil
5.	U19BMOE003	Hospital Management system	OE	3	3	0	0	3	Nil
6.	U19BMOE004	Biomedical Instrumentation	OE	3	3	0	0	3	Nil
7.	U19CEOE003	Remote Sensing and GIS	OE	3	3	0	0	3	Nil
8.	U19CEOE004	Air Pollution And Control Engineering	OE	3	3	0	0	3	Nil
9.	U19CSOE003	Data Structures and Algorithms	OE	3	3	0	0	3	Nil
10.	U19ECOE003	Consumer Electronics	OE	3	3	0	0	3	Nil
11.	U19ECOE004	Advanced WIRELESS Communication	OE	3	3	0	0	3	Nil
12.	U19EEOE003	Sensors and Transducers	OE	3	3	0	0	3	Nil
13.	U19EEOE004	Energy Technology	OE	3	3	0	0	3	Nil
14.	U19FTOE003	Beverage Technology	OE	3	3	0	0	3	Nil
15.	U19FTOE004	Processing of Food Materials	OE	3	3	0	0	3	Nil
16.	U19ITOE003	Foundations of Information Technology	OE	3	3	0	0	3	Nil
17.	U19ITOE004	Web Design and Management	OE	3	3	0	0	3	Nil
18.	U19MEOE003	Automobile Technology	OE	3	3	0	0	3	Nil
19.	U19MEOE004	CAD/CAM	OE	3	3	0	0	3	Nil
20.	U19PHOE002	Thin film Technology and Applications	OE	3	3	0	0	3	Nil
21.	U19CHOE001	Environmental Sciences	OE	3	3	0	0	3	Nil
22.	U19ENOE02	English for Employability Skills	OE	3	3	0	0	3	Nil
23.	U19EDOE001	Intellectual Property Rights	OE	3	3	0	0	3	Nil

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CREDITS SUMMARY

S.No	SUBJECT AREA	CREDIT DISTRIBUTION								CREDITS TOTAL	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1	**HS**	5	3	-	-	-	-	-	-	8	4.52
2	**BS**	9	8	4	3	-	-	-	-	24	13.56
3	**ES**	7	7	3	-	-	-	-	-	17	9.60
4	**PC**	3	3	13	17	19	15	10	-	80	44.63
5	**PE**	-	-	-	-	3	3	3	6	15	8.47
6	**OE**	-	-	-	-	-	3	3	-	6	3.39
7	**CC**	-	-	-	-	-	-	-	-	-	-
8	**EEC**	2	2	2	2	4	3	3	6	25	15.82
Total		**26**	**23**	**22**	**22**	**26**	**24**	**19**	**12**	**174**	**100**

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SEMESTER – I

U19ENTL101T	COMMUNICATIVE ENGLISH (Common to all Programmes)	L	T	P	C
		2	0	0	2

Course Objectives

This course aims to provide,

- To enhance learners' listening skills so as to help them to comprehend conversations and lectures in diverse contexts.
- To develop the speaking skills of learners with fluency and appropriacy in order to express their ideas, views and opinions in varied formal and informal contexts and social situation.
- To inculcate the habit of reading using different types of reading strategies for understanding contextual situations.
- To develop the learners to write various writing forms effectively and coherently in an appropriate style.
- To develop linguistic competence and performance to express ideas effectively and appropriately in different contexts.

Course Outcome:

At the end of the course students will be able to,

CO1 : Listen and comprehend technical and non-technical spoken experts critically and functionally using BEC modules.

CO2 : Write different forms of writing effectively and apparently and create advance level of writing in English.

CO3 : Read different genres of text, analysing and interpreting it by guessing the meaning from the context and employ it for new ideas, to learn and present.

CO4 : Speak fluently using the proper vocabulary, modulation, articulation and pronunciation.

CO5 : Familiarize the soft skills needed for the employability and gaining functional understanding of the language.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	2	2	2	3	-	2	-	-	2
CO2	-	-	-	-	-	-	-	1	2	3	-	2	-	-	2
CO3	-	-	-	-	-	2	-	2	3	3	-	2	-	-	2
CO4	-	-	-	-	-	-	3	2	1	3	-	3	-	-	3
CO5	-	-	-	-	-	3	3	3	3	3	-	3	-	-	3

UNIT I INTRODUCTION TO BUSINESS COMMUNICATION 6

Parts of Speech - Jumbled words – Making mild Suggestions / offers / invitations – Discourse Markers – Letter writing (Request / Complaint / Thanking) .

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UNIT II EXTENDED WRITING 6

Seeking advice / Information politely – Root words – Present Tense - Reading Comprehension (MCQ) – Paragraph writing.

UNIT III READING COMPREHENSION 6

Past Tense – Phrasal Verbs - Jargon – Making polite requests – Reading and comprehending newspaper articles – Hints Development.

UNIT IV EXTENDED GRAMMAR CONCEPTS 6

Future Tense - Determiners – Making enquiries / requests indirectly and politely - Indicating Preference - Reading Comprehension (Short questions) – Constructing conversations (Formal and Informal).

UNIT V TECHNICAL COMMUNICATION 6

Pointing out mistakes and unpleasant things politely – Asking yes or no type questions and wh-questions indirectly and politely – Misspelled words - Cloze reading - Picture Description – Jumbled sentences.

Total: 30 Hours

Text Books:

T1 Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning ,USA: 2007.

T2 Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student‘s Book). Cambridge University Press, New Delhi: 2005.

Reference Books:

R1 Carter, R., & McCarthy, M. (2006). Cambridge grammar of English: A comprehensive guide: spoken and written English grammar and usage. Cambridge University Press.

R2 Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.

R3 Meenakshi Raman and Sangeeta Sharma. Technical Communication. Oxford University Press. 2018.

Web Resources:

W1 http://www.bbc.co.uk/learningenglish/features/pronunciation

W2 http://www.bbc.co.uk/worldservice/learningenglish/language/

W3 https://www.pechakucha.com/

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U19MATH104	MATRICES, SOLID GEOMETRY AND CALCULAS FOR CIVIL ENGINEERING	L	T	P	C
		3	1	0	4

Course Objectives:

This course aims to provide,

- An essential tool for describing and analysing engineering process and systems.
- Precise representation and communication of knowledge.
- Understanding the basics and importance of Matrix Theory, Trigonometry, Solid Geometry and Differential Calculus which are being widely used in Civil Engineering studies.

Course Outcomes:

At the end of the course students should be able to,

CO1 : Calculate the rank of a matrix, Eigen values, Eigen vectors and solutions of system of equations.

CO2 : Use the applicability of Cayley – Hamilton theorem to find the inverse of a matrix and diagonalization of matrix.

CO3 : Acquire complete knowledge related to angles which play a vital role in measurements and land survey.

CO4 : Determine the equations of straight lines, shortest distance between the skew lines and acquire knowledge about the spherical objects.

CO5 : Gain knowledge to find the radius of curvature, torsion of a curve which is helpful in the study of beams and its related problems.

CO6 : Apply the concepts of Matrices, Solid Geometry and Calculus in Civil Engineering Field.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	-	-	-	-	-	2	2	2	
CO2	3	3	2	-	2	-	-	-	-	-	-	2	2	2	
CO3	3	3	2	-	2	-	-	-	-	-	-	2	2	2	
CO4	3	3	2	-	2	-	-	-	-	-	-	2	2	2	
CO5	3	3	2	-	2	-	-	-	-	-	-	2	2	2	
CO6	3	3	2	2	1	-	-	-	-	2	-	3	3	3	

(3 – High, 2 – Medium, 1 – Low)

UNIT I MATRICES 9+3

Consistency of linear system of equations – Rouche's theorem– Linear transformations – Vectors – Linear dependence – Eigen values and Eigen vectors of a real matrix– Properties of Eigen values and Eigen vectors (excluding proof) – Applications of Matrices.

UNIT II DIAGONALIZATION OF A REAL SYMMETRIC MATRICES 8+3

Cayley - Hamilton Theorem (excluding proof) – Orthogonal matrix – Diagonalization of matrices – Reduction of Quadratic form to Canonical form by orthogonal transformation – Applications of Diagonalization of a real symmetric matrices.

UNIT III TRIGONOMETRY 9+3

Trigonometric ratios – Trigonometric identities – Sine and Cosine formula of triangle (Concepts only) – De Moivre's Theorem – Expansions of $\sin n\theta$, $\cos n\theta$, $\sin^n\theta$ and $\cos^n\theta$ – Hyperbolic functions – Applications of trigonometry.

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UNIT IV SOLID GEOMETRY 9+4

Equation of a plane – Equations of a straight line – conditions for a line to lie in a plane – Coplanar lines – shortest distance between two skew lines – Sphere – Section of a sphere by a plane – Equation of the tangent plane – Orthogonal spheres – Application of solid geometry.

UNIT V DIFFERENTIAL CALCULUS AND ITS GEOMETRICAL APPLICATIONS 9+3

Derivatives – Curvature – Radius of curvature in Cartesian and Parametric forms – Simple problems – Centre of curvature – Circle of curvature – Involutes and Evolutes of Parabola – Applications of differential calculus and its geometrical applications.

Total: 60 Hours

Text Books:

T1. Grewal. B. S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.

Reference Books:

R1. Kreyzig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley and sons, 2015.

R2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

R3. Peter V. O.Neil," Advanced Engineering Mathematics", 8th Cengage learning, New Delhi 2012.

R4. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt Ltd., 2016.

R5. Venkataraman M.K., Engineering Mathematics – I Year (2nd edition), National Publishing Co., Chennai,2000.

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U19PHTL103T **APPLIED PHYSICS FOR CIVIL ENGINEERING**

L	T	P	C
2	0	0	2

Course Objectives:

This course aims to provide,

- To impart knowledge on the basics of Ultrasonics and its applications in Non-destructive testing methods.
- To introduce the concepts of sound insulation.
- To introduce the concepts of lighting designs.
- To acquire a basic understanding of various atomic and crystal structures of the materials.
- To understand the various types of bonding in solids.
- To learn nanotechnology with applications and different characteristic methods for nanomaterials.

Course Outcomes:

At the end of the course students should be able to,

CO1 : Know the different non-destructive testing methods for finding the various defects in the materials.

CO2 : Understand the acoustical effects in the building constructions and their remedies.

CO3 : Realize the lighting importance and methods for facilitating the same by improvising the basic accessories in the buildings.

CO4 : Describe the various crystal structures and bonding in solids.

CO5 : Describe the different types bonding in solids.

CO6 : Understanding the phenomenon of nanomaterial and processing methods.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I ULTRASONICS AND NDT METHODS **6**

Ultrasonic wave- properties- production of ultrasonic wave (Magnetostriction and Piezo electric oscillator) – detection of Ultrasonic-wavelength – Applications – Non-destructive testing (NDT) - principles and characteristic parameters of ultrasonic testing – Ultrasonic testing methods and system-Echo – Encephalograph.

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UNIT II ACOUSTICS BUILDING AND QUIETING 6

Classification of sound – decibel - Weber – Fechner law – Sabine's formula- derivation using growth and decay method. Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Methods of sound absorptions – absorbing materials – noise and its measurements, sound insulation and its measurements, impact of noise in multi-storeyed buildings. Acoustic quieting- aspects of Acoustic quieting- Acoustic for specific observers - Muffer – Sound Proofing.

UNIT III LIGHTING DESIGNS 6

Radiation quantities – spectral quantities – relationship between luminescence and radiant quantities – hemispherical reflectance and transmittance – photometry: cosines law, inverse square law. Vision – photobic, mesophic, scotopic visions. Colour – luminous efficiency function – Visual field glare, colour – day light calculations – day light design of windows, measurement of day light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

UNIT IV CRYSTAL STRUCTURE AND BONDING IN SOLIDS 6

Solids – types – crystal – lattice – basis, primitive lattice cell, unit cell, seven crystal system – Crystal direction and plane- -miller indices- Interplanar spacing- the structure of KCl and NaCl Crystals – Types of bonding- Ionic bond- characteristics of ionic bond- Covalent bond – characteristics of covalent bond – Metallic bond – characteristics of metallic bond- Vander Waals bonding –Cohesive energy of Ionic Crystal.

UNIT V NANOSTRUCTURE AND TECHNOLOGY 6

Nanoscience and origin of nanotechnology Nanoscale and its significance-surface to volume ratio-Quantum Confinement (Quantum Well, wire and Dots) – synthesis of nanoparticles and Quantum Dots properties-carbon nanotubes-synthesis-properties, Application of nanotechnology.

Total: 30 Hours

Text Books:

T1. S.J.Gupta, Sanjeev Gupta, Modern Engineering Physics, Dhanpat Rai Publication, New Delhi, 2015.

T2. R.Balasubramaniam, Callister's, Material Science and Engineering, Wiley,2nd edition, 2014.

T3. H.Sathayaseelam, Laboratory Manual in Applied Physics, Second edition, -New age International Publication, 2015.

Reference Books:

R1. Mark Karlen, James R. Benya, Christina Spangler, Lighting Design Basics, John Wiley & Sons; 2nd edition (11 May 2012).

R2. David Halliday, Robert Resnick and Jearl Walker, Fundamentals of Physics, John Wiley &Sons ,New Delhi , 9th Edition , 2010

R3. Shatendra Sharama, Jyostsna Sharma, Engineering Physics, Pearson, Uttar Pradesh, 2019.

R4. B.K.Pandey, S.Chaturvedi, Engineering Physics, Cengage Publication, New Delhi, 2018.

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U19CSTL101T	COMPUTATIONAL THINKING AND PROBLEM SOLVING	L	T	P	C
		3	0	0	3

Course Objectives

The course aims to provide,

- To understand the various general steps in problem solving.
- To analyse the efficiency of the algorithms.
- To learn to solve problems using C.
- To understand the concept of arrays and strings.
- To learn C functions and storage classes.

Course Outcomes:

At the end of the course students should be able to,

CO1 : Understand the fundamental concepts of computer and operating systems.
CO2 : Understand and apply number system conversions.
CO3 : Create the algorithm and flow charts for a given problem.
CO4 : Understand the basics of C programming, choose the right data representation formats.
CO5 : Design and implement applications in C using arrays and strings.
CO6 : Develop and implement application applications in C using functions.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	3	-	1	-	-	-	-	-	-	-	3	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	-	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	-	3	-	3	-	-	-	-	-	-	-	3	2	2
CO5	3	2	-	2	-	-	-	-	2	-	2	2	1	2	2
CO6	3	2	3	2	-	-	-	-	2	-	2	2	2	3	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO COMPUTER PROBLEM SOLVING 9

Computers – Introduction, CPU – ALU, Memory – RAM/ROM, Input/Output, hard disk, storage. The problem solving Aspect, Top-Down Design, Implementation of Algorithms, Program Verification, Introduction, Information and data, Data encoding, number systems. Logic: Boolean logic.

UNIT II PROBLEM SOLVING TECHNIQUES AND ALGORITHMIC THINKING 9

Problem definition, logical reasoning, problem decomposition, abstraction. Flowchart: Name binding, Selection, Repetition, Modularization. Data Organization: List and Arrays. Simple algorithms, Factoring and recursion techniques.

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UNIT III C PROGRAMMING FUNDAMENTALS 9

Introduction to C Language – Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic, Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions. If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do While and Examples. Continue Break and Goto statements.

UNIT IV ARRAYS & STRINGS 9

Arrays – Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear Search, Selection Sort. Strings – Concepts, C Strings, String Input/output Functions, Arrays of Strings, String Manipulation Functions.

UNIT V FUNCTIONS 9

Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, and Methods of Parameter Passing. Recursion- Recursive Functions. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

Total: 45 Hours

Text Books:

T1. David Riley and Kenny Hunt, "Computational Thinking for Modern Solver", Chapman & Hall/CRC 2014.

T2. R.G.Dromey, "How to Solve it by Computer", PHI, 2008

Reference Books:

R1. Seyed H Roosta, "Foundations of programming languages design & implementation", Cengage Learning. 2009.

R2. Karl Beecher, "Computational Thinking: A beginner's guide to problem-solving and programming", BCS, The Chartered Institute for IT; 1 edition, 2017.

R3. Wladston Ferreira Filho, "Computer Science Distilled: Learn the Art of Solving Computational Problems", Code Energy LLC, 2017.

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U19CETL101T	INTRODUCTION TO CIVIL ENGINEERING	L	T	P	C
		2	0	0	2

Course Objectives

This course aims to provide,

- An over view of Civil Engineering Profession.
- Knowledge on various elements of building construction.
- To provide students an overview of transportation and Water resource management.

Course Outcomes:

At the end of the course students should be able to,

CO1 : Gain brief knowledge about civil engineering and its various branches.

CO2 : Acquire knowledge about surveying and its uses.

CO3 : Understand the planning and construction aspects of a building.

CO4 : Understand the need and role of transportation in National development.

CO5 : Gain knowledge about various types of water sources and water management.

CO6 : Produce clear, concise written explanations of basic civil engineering principles.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	1	1	-	2	1	-	1	-	2	3	1	3
CO2	3	2	-	1	3	2	-	-	2	-	-	3	3	2	3
CO3	3	1	2	1	1	1	1	-	2	1	-	3	1	3	1
CO4	2	2	2	-	3	1	1	-	-	2	-	3	2	2	-
CO5	-	2	-	-	3	3	3	-	-	1	-	3	3	2	-
CO6	3	2	2	1	-	3	3	-	-	-	-	3	3	1	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I GENERAL INTRODUCTION 6

General introduction to Civil Engineering – History of Civil Engineering – Relevance of Civil Engineering in the overall infrastructural development of the country – Various branches in Civil Engineering. Types and classification of structures – buildings, towers, chimneys, bridges, dams, retaining wall, water tank, silos.

UNIT II SURVEYING 6

Surveying and Levelling – objectives and uses – primary divisions – Fundamental Principles – Classification of Surveying – Plans and maps, Scales, Units of measure, Conventional symbols. Chaining – methods – instruments used in chaining. Compass Surveying: Types and uses of compass. Elevation measurements: Levelling – object and used – terms used in levelling – Modern Surveying: GPS.

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UNIT III ELEMENTS OF BUILDING CONSTRCUTION 6

Planning: Elementary principles and basic requirements of a building plan. Foundation plan, Electrical installation plan. Selection of site – Construction: design loads, Components of a building and their function – setting out of a building. Building byelaws.

UNIT IV TRANSPORTATION 6

Role of transportation in National development – Elements of traffic engineering, Suitability and requirement of different transportation systems – Introduction to railway engineering – MRTS, BOT projects, Traffic control.

UNIT V WATER RESOURCE MANAGEMENT 6

Introduction to hydrology – Sources of water – Water requirement, water conservation, water conveyance system – need for water conservation – quality of drinking and irrigation water.

Total: 30 Hours

Text Books:

T1. Gurucharan Singh, "Standard Handbook on Civil Engineering", Standard Publisher Distributors, New Delhi, 9th edition, 2017.

T2. Dr. P. Purushothama Raj, V. Ramachandran, "Introduction to Civil Engineering", Sri Krishna Hitech Publishing Company Pvt ltd.

Reference Books:

R1. B.C Punmia, "Surveying Vol I", Laxmi Publications Pvt ltd, Sixteenth edition, July 2005.

R2. Keeble Lewis, Principles and Practises of Town and Country planning, Estates gazette, 1969.

R3. S.V. Deodhar, "Building Science and Planning", K.G. Saur, 1996.

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U19CETL102T	ENGINEERING GRAPHICS	L	T	P	C
		2	0	0	2

Course Objectives:

This Course aims to provide,

- Graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.
- Gives the Hands-On experience with Auto CAD.

Course Outcomes:

At the end of the course students should be able to,

CO1 : Sketch engineering objects, lettering and dimensioning by freehand.
CO2 : Create geometric constructions, drawing parallel and perpendicular lines, circles, arcs, tangencies and irregular curves.
CO3 : Apply orthographic projection method to obtain: Multiview and section view of an object.
CO4 : Understand the concept of projection and acquire visualization skills, projection of points
CO5 : Apply good dimensioning practise, by considering the type of dimensioning and correct location.
CO6 : Create 2D and 3D computer drawing: use industry standard Computer Aided Design (CAD) software.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	-	3	2	-	-	1	-	-	2	3	2	-
CO2	3	-	1	2	-	-	-	-	1	-	-	2	3	2	-
CO3	3	2	3	-	3	1	-	-	2	-	-	3	3	3	-
CO4	2	-	-	1	2	-	-	-	2	-	-	3	2	3	-
CO5	1	-	-	1	-	1	-	-	-	-	-	3	1	3	-
CO6	3	-	-	-	3	-	-	-	-	-	-	3	3	3	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I PLANES CURVES, PROJECTION OF POINTS, LINES AND PLANES 6

Importance of graphics in design process, visualization, communication, documentation and drafting tools, Construction of curves – ellipse, parabola, and hyperbola by eccentricity method only. Orthographic projection of points. Projections of straight lines located in first quadrant – determination of true length and true inclinations.

Projections of plane surfaces – polygonal lamina and circular lamina, located in first quadrant and inclined to one reference plane.

UNIT II PROJECTION AND SECTION OF SOLIDS 6

Projection of simple solids – prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.

Sectioning of simple solids – prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.

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UNIT III **DEVELOPMENT OF SURFACES, ISOMETRIC PROJECTIONS AND FREE-HAND SKETCHING** **6**

Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones. Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones. Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning.

UNIT IV **INTRODUCTION TO AUTOCAD** **6**

Introduction to Drafting Software (AutoCAD) & its Basic Commands. Introduction to coordinate systems, object selection methods, selection of units and precession. Sketching – line, circle, arc, polygon, rectangle and ellipse. Working with object snaps, layers and object properties. Editing the objects – copy, move, trim, extend, working with arrays, mirror, scale, hatch, fillet and chamfer.

UNIT V **ISOMETRIC VIEWS USING AUTOCAD** **6**

Isometric views of simple solid blocks – Prisms, Cone, Cylinder and Pyramid.

Total: 30 Hours

Text Books:

T1. Venugopal K and Prabhu Raja V, Engineering Graphics, New Age International Pvt Ltd, 2008.

T2. Natarajan K.V, A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai – 2010.

Reference Books:

R1. Basant Agarwal and Agarwal C M, Engineering Drawing, Tata McGraw Hill Publishing Comoany Ltd, New Delhi – 2008.

R2. Bhatt N.D and Panchal V.M, Engineering Drawing, Charotar Publishing House, 50th edition 2010.

R3. Gopalakrishna K.R, Engineering Drawing, (Vol. I & II combined), Subhas Stores, Banglore – 2007.

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U19LATH101	LANGUAGE – TAMIL (Common to All programmes)	L 2	T 0	P 0	C 2

Course Objectives

This Course aims to provide,

- To enhance listening skill of the learners and practicing it for a better professional as well as moral skills
- To read different text without barriers using reading strategies

Course Outcomes:

At the end of the course students should be able to,

CO1 : Learn the language literature concepts.
CO2 : Speak fluently using the proper vocabulary.
CO3 : Familiarize the functional understanding of the language grammar.
CO4 : Understand the concepts of new era tamil literature works
CO5 : Develop the reading skills of tamil novels and stories.
CO6 : Enhance the features of story telling, conversation and creative skills of writing in students.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	2	2	2	3	-	2	-	-	2
CO2	-	-	-	-	-	-	-	1	2	3	-	2	-	-	2
CO3	-	-	-	-	-	2	-	2	3	3	-	2	-	-	2
CO4	-	-	-	-	-	-	3	2	1	3	-	3	-	-	3
CO5	-	-	-	-	-	3	3	3	3	3	-	3	-	-	3
CO6	-	-	-	-	-	-	2	2	2	3	-	2	-	-	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I **அலகு – 1** **5**

சங்ககாலம்- மூன்றுசங்கங்கள்- முதற்சங்கம் (கடல்கொண்டதென்மதுரை)- இடைச்சங்கம் (கபாடபுரம்)-கடைச்சங்கம்(மதுரை)-சங்க இலக்கியங்கள்- பதினெண்மேற்க்கணக்கு நூல்கள்: எட்டுத்தொகைநூல்கள் (ஐங்குறுநூறு, குறுந்தொகை,கலித்தொகை, நற்றிணை, அகநானூறு, புறநானூறு, பதிற்றுப்பத்து, பரிபாடல்)- பத்துப்பாட்டு நூல்கள் (சிறுபாணாற்றுப்படை, பெரும்பாணாற்றுப்படை, திருமுருகாற்றுப்படை, பொருநராற்றுப்படை, மலைபடுகடாம், குறிஞ்சிப்பாட்டு, முல்லைப்பாட்டு, பட்டினப்பாலை, நெடுநல்வாடை, மதுரைக்காஞ்சி.)- சங்கம்மருவியகாலம்- பதினெண்கீ ழ்க்கணக்கு நூல்கள் (திருக்குறள், நாலடியார், நான்மணிக்கடிகை, இன்னாநாற்பது, இனியவைநாற்பது, திரிகடுகம், ஆசாரக்கோவை, பழமொழி, சிறுபஞ்சமூலம், முதுமொழிக்காஞ்சி, ஏலாதி, கார்நாற்பது, களவழிநாற்பது, ஐந்திணைஐம்பது, திணைமொழிஐம்பது, ஐந்திணைஎழுபது, திணைமாலை நூற்றைம்பது, கைந்நிலை)- காப்பியங்கள்- ஐம்பெருங்காப்பியங்கள்- (சிலப்பதிகாரம், மணிமேகலை, சீவகசிந்தாமணி, வளையாபதி, குண்டலகேசி)- ஐஞ்சிறுகாப்பியங்கள் (நாககுமாரகாவியம்,

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உதயணகுமாரகாவியம், யசோதரகாவியம், சூளாமணி, நீலகேசி)- இலக்கணம் - எழுத்து, சொல், பொருள், யாப்பு, அணி – தமிழ் எழுத்துக்கள்- உயிரெழுத்துக்கள், மெய்யெழுத்துக்கள், உயிர்மெய் எழுத்துக்கள், ஆய்தஎழுத்து- வகைகள்- குறில், நெடில், வல்லினம், மெல்லினம், இடையினம், குற்றியலுகரம், குற்றியலிகரம்.

UNIT II அலகு – 2 **5**

மயங்கொலிப்பிழைகள் - ர, ற- ஒலி வேறுபாடுகள- ல, ள, ழஒலிவேறுபாடுகள்-ந, ன, ண- ஒலி வேறுபாடுகள்- சொல் இலக்கணம் - திணை, பால், எண், இடம், காலம் - பேச்சுவழக்கு– எழுத்து வழக்கு – இழி வழக்குச் சொற்கள்- வழூவுச்சொற்கள் – இணைச்சொற்கள்- தொகைச்சொற்கள் – நிறுத்தற்குறியீடுகள்- உவமைத்தொடர்கள்- மரபுத்தொடர்கள்- வாக்கியத்தில் அமைத்தல் – மரபுப்பிழை திருத்தம் – ஐந்திணை- பலபொருள் ஒருசொல் – ஒருசொல் பலபொருள்

UNIT III அலகு – 3 **5**

அணி இலக்கணம் – இயல்புநவிற்சி அணி, உயர்வுநவிற்சி அணி, உவமை அணி- எடுத்துக்காட்டுஉவமை அணி, உருவக அணி, ஏகதேச உருவக அணி, சொற்பொருள் பின்வருநிலைஅணி, தற்குறிப்பேற்ற அணி, வேற்றுமை அணி, வஞ்சப்புகழ்ச்சி அணி, மடக்கணி. பொருந்திய சரியான சொல்லைத் தேர்ந்தெடுத்தல் செய்யுள் பொருளுணர்திறன்.

UNIT IV அலகு – 4 **5**

திருக்குறள்- 50 குறள்கள்- ஆத்திச்சூடி- கவிதைகள்- பாரதியார் (மனதில் உறுதி வேண்டும்)- பாரதிதாசன் (கனியிடை ஏறியசுளையும்)- வைரமுத்து (ஆதலால்மனிதா…) பெய்யெனப் பெய்யும் மழை கவிதைத்தொகுப்பு-காசி ஆனந்தன் (மாடியிலிருந்து…)-நறுக்குகள் கவிதைத் தொகுப்பு- பழமொழிகள்- விடுகதைகள்

UNIT V அலகு – 5 **5**

சிறுகதைகள் – ஜெயமோகன், ஜெயகாந்தன், கி.ராஜநாராயணன், பிரபஞ்சன் நீதிக்கதைகள், மொழிபெயர்ப்பு- மூன்றில் ஒருபங்காகச் சுருக்குதல் வினாவிற்கேற்ற விடைகள்- கடிதங்கள்-தலைவர்கள் மற்றும் அறிஞர்கள் பற்றிய கட்டுரைகள்

UNIT VI அலகு – 6 **5**

படைப்பாற்றல்பயிற்சி – பேச்சுப்பயிற்சி (கதைசொல்லுதல், விவாதித்தல், கவியரங்கம், பட்டிமன்றம்)-எழுத்துப்பயிற்சி (கவிதை, கட்டுரை, சிறுகதை, கடிதங்கள்)

Total: 30 Hours

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U19LATH101	LANGUAGE – MALAYALAM (Common to All programmes)	L 2	T 0	P 0	C 2

Course Objectives

This Course aims to provide,

- To Write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.
- To develop an interest in the mother tongue through the study of literature and other contemporary forms of culture.
- To be proficient in speaking and listening and assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning
- To enhance reading and writing skills for a better understanding of the main contextual ideas
- To use their mother tongue in the formal setup to express their views and ideas using the appropriate vocabulary and phrases.

Course Outcomes:

At the end of the course students should be able to,

CO1 : Students should be familiar with literary and cultural texts within a significant number of historical, geographical, and cultural contexts.

CO2 : Students should be able to apply critical and theoretical approaches to the reading and analysis of literary and cultural texts in multiple genres.

CO3 : Students should be able to ethically gather, understand, evaluate, and synthesize information from a variety of written and electronic sources from different genres.

CO4 : Students should be able to write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.

CO5 : Students should be able to understand the process of communicating and interpreting human experiences through literary representation using historical contexts and disciplinary methodologies.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	3	1	2	3	-	2	-	-	2
CO2	-	-	-	-	-	-		2	-	3	-	2	-	-	2
CO3	-	-	-	-	-	-	3	-	3	3	-	2	-	-	3
CO4	-	-	-	-	-	-	1	-	2	3	-	3	-	-	3
CO5	-	-	-	-	-	-	-	1	3	3	-	3	-	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I GRAMMAR AND LANGUAGE DEVELOPMENT 5

Writing – letters, swaraksharangal, vyanjanaksharangal, Error – free Malayalam:
1. Language; 2. Clarity of expression; 3. Punctuation.

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UNIT II LETTER WRITING 5

Letter writing: Formal (applications, letter to the editor of a Newspaper, commercial correspondence, complaints) and informal letters.

UNIT III READING COMPREHENSION 5

Reading section: Comprehension of unseen prose passages and Short stories

UNIT IV EXTENDED SPEAKING 5

Expansion of ideas: Proverbs, poems, and philosophical statements.

UNIT V INTRODUCTION TO MALAYALAM LITERATURE 5

Critical appreciation of literary works (Books and Films). Literary & Cultural figures of Kerala and their literary contributions.

Total: 30 Hours

Text Books:

T1. John D Kunnathu, Lissy J Kunnathu, "Learn Basic Malayalam In Six Weeks: With Daily Worksheets & Answer Key" CreateSpace Independent Publishing Platform (June 22, 2015).

T2. Vidvan C. L. Meenakshi Amma. "Learn Malayalam, manuals_contributions; manuals", Additional_collections, 1975.

T3. John D. Kunnathu, Lissy J. Kunnathu, "Learn Basic Malayalam in Six Weeks: With Daily Worksheets & Answer Key" Kindle Edition.

T4. H. Gundert, "A Grammar of the Malayalam Language", Basel Mission Press, 2002.

T4. Malayalam Grammar Book Paperback, Kindle Edition, 2018.

Reference Books:

R1. Malayalam: A University Course and Reference Grammar. – Fourth Edition, The Center for Asian Studies at The University of Texas at Austin, 2018.

R2. B. Shyamala Kumari , "An Intensive Course in Malayalam (An Old and Rare Book)", Central Institute of Indian Languages, Mysore, 1999.

Web resources:

1. https://e-resources.saraswatihouse.com
2. https://www.alllanguageresources.com/malayalam/
3. https://www.alllanguageresources.com › Malayalam

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U19LAEN101	FOUNDATION ENGLISH (Common to All programmes)	L 2	T 0	P 0	C 2

Course Objectives

This Course aims to provide,

- Educate students in both the artistry and utility of the English language through the study of literature and other contemporary forms of culture.
- Provide students with the critical faculties necessary in an academic environment, on the job, and in an increasingly complex, interdependent world.
- Graduate students who are capable of performing research, analysis, and developing content from different genres.
- Assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning.
- Write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.

Course Outcomes:

At the end of the course students should be able to,

CO1 : Get be familiar with literary and cultural texts within a significant number of historical, geographical, and cultural contexts.

CO2 : Apply critical and theoretical approaches to the reading and analysis of literary and cultural texts in multiple genres.

CO3 : Ethically gather, understand, evaluate, and synthesize information from a variety of written and electronic sources from different genres.

CO4 : Write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.

CO5 : Understand the process of communicating and interpreting human experiences through literary representation using historical contexts and disciplinary methodologies.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	3	1	2	3	-	2	-	-	2
CO2	-	-	-	-	-	-		2	-	3	-	2	-	-	2
CO3	-	-	-	-	-	-	3	-	3	3	-	2	-	-	3
CO4	-	-	-	-	-	-	1	-	2	3	-	3	-	-	3
CO5	-	-	-	-	-	-	-	1	3	3	-	3	-	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO ENGLISH LITERATURE 5

Introduction to the English Language – Introduction to Indian writing in English – Palanquin Bearers by Sarojini Naidu – To me, fair friend, you never can be old, Sonnet 104 by Shakespeare.

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UNIT II APPRECIATION OF POEMS 5

Ode on a Grecian Urn by John Keats – Gitanjali by Rabindranath Tagore.

UNIT III FOCUS ON SHORT STORIES 5

Short Stories: A Christmas Carol by Charles Dickens – The Open Window by Saki – The Interpreter of Maladies by Jhumpa Lahiri – Success Stories of inspirational leaders: Martin Luther King, Malala Yousafzai & Saalumarada Thimmakka, also known as Aalada Marada Timakka, an Indian environmentalist.

UNIT IV FOCUS ON NOVEL 5

Novel: The Man-Eater of Malgudi by R.K.Narayan

UNIT V FOCUS ON DRAMA 5

A Doll's House by Norwegian playwright Henrik Ibsen

Total: 30 Hours

Text Books:

T1. Palanquin Bearers Paperback by Sarojini Naidu (Author), Indu Harikumar (Illustrator)

T2. Sonnet 104: To Me, Fair Friend, You Never Can Be Old Emma Abbate & Ashley Riches From the Album Mario Castelnuovo-Tedesco: Shakespeare Sonnets.

T3. Ode On A Grecian Urn And Other Poems (English, Paperback, Keats John), Publisher: Kessinger Publishing Co, Genre: Poetry, ISBN: 9781419137730

T4. Gitanjali by Rabindranath Tagore, Kindle edition

T5. The Man-eater of Malgudi by R.K. Narayan (Author), Repro Books

T6. A Doll's House by Henrik Ibsen, Maple Press, Genre: Fiction, ISBN: 9789350330685

Reference Books:

R1. The Open Window and Other Short Stories, Kindle Edition

R2. Charles Dickens' Christmas Stories: A Classic Collection, 2019, Kindle Edition

Web resources:

1. https://www.deccanchronicle.com/lifestyle/books-and-art/220418/saalumarada-thimmakka-the-green-legend-now-on-stage.html
2. https://malala.org/malalas-story
3. https://www.nobelprize.org/prizes/peace/1964/king/biographical/

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U19CCEX101	ENGINEERING EXPLORATION – I	L	T	P	C
		1	0	2	2

Course Objectives

- To understand the role of engineers as a problem solver.
- To learn engineering design aspects and multi-disciplinary approach.
- To find solutions to complex problems through engineering design utilizing multi-disciplinary systems approach.
- To examine the given problem using process of engineering problem analysis.
- To collect data in different forms and to have visual analysis.

Course Outcomes:

At the end of the course students should be able to,

CO1 : Understand the role of an Engineer as a problem solver.

CO2 : Able to learn design engineering solutions to complex problem utilizing multi-disciplinary systems approach.

CO3 : Examine a given problem using process of engineering problem analysis.

CO4 : Identification of variables involved in problem analysis and conducting experiments.

CO5 : Recording data and analyse.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	-	-	-	-	-	-	1	-	3	1	-
CO2	1	2	1	3	-	-	-	-	-	3	-	-	3	1	-
CO3	1	2	3	2	2	1	-	-	-	-	1	-	3	1	-
CO4	3	2	1	2	2	1	-	-	-	3	1	-	3	2	-
CO5	3	-	1	2	-	1	-	-	-	3	-	-	3	1	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTROUCTION TO ENGINEERING AND ENGINEERING STUDY 3+6

Difference between science and engineering, Problem space of an engineer (needs) various disciplines of engineering, some misconceptions of engineering, Expectation of the 21st century engineer and Graduate Attributes.

UNIT II ENGINEERING DESIGN 3+6

Engineering design process, Importance of analysis in engineering design, general analysis procedure, Multidisciplinary facet of design, Mechatronics system design, 12V DC power supply design, Conversion of Electrical to Mechanical Energy.

UNIT III MECHANISMS 3+6

Mechanisms and machines, Different types of mechanisms (focus on linkages), Degrees of freedom or mobility of a mechanism, 4-Bar mechanism: Crank rocker Mechanism, Slider Crank Mechanism.

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UNIT IV PLATFORM BASED DEVELOPMENT 3+6

Introduction to systems and platform based development, Ardunio as a development board, Sensors, actuators and control, Interfacing of I/O devices, Pulse with modulation, Analog and Digital data.

UNIT V DATA ACQUISITION AND ANALYSIS 3+6

Types of Data, Descriptive statistics techniques as applicable to different types of data, Types of graphs as applicable to different types of data, Usage of Microsoft Excel tool for descriptive statistics, Data Acquisition (Temperature and humidity) using sensors interfaced with Arduino, Exporting acquired data to Microsoft Excel and analysis using visual representation.

Total : 45 Hours

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U19AEPC101	CROP PRODUCTION LABORATORY	L	T	P	C
		1	0	2	2

Course Objectives:

This course aims to provide the students,

- To introduce the students to principles of field crops production and to introduce the production practices of crops.
- To delineate the role of agricultural and irrigation engineers in relation to various crop production practices.
- To equip the students with necessary theoretical and practical knowhow on basic principles of cropping and acquaint them with the cultivation practice of few important crops of Tamil Nadu.

Course Outcomes:

At the end of the course students should be able to,

CO1 : Knowledge on crop selection, production and management.
CO2 : Able to understand the importance of crop water management
CO3 : Understand the cultivation practices for some of the important crops in Tamil Nadu
CO4 : Good knowledge in the field preparation of crops including systems of tillage
CO5 : Sound understanding of the production practices of vegetable crops
CO6 : Students will gain good knowledge in the production of agricultural and horticultural crops

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	2	-	-	-	-	-	-	2	2	-
CO2	3	3	-	2	-	2	2	-	-	-	-	-	2	2	-
CO3	3	3	-	2	2	2	1	-	-	-	-	-	2	2	-
CO4	3	3	-	1	2	2	2	-	-	-	-	-	2	2	-
CO5	3	3	-	-	-	2	2	-	-	-	-	-	2	2	-
CO6	3	3	-	2	-	2	-	-	-	-	-	-	2	2	-

(3 – High, 2 – Medium, 1 – Low)

List of Components:

1. To introduce the different crop production practices in wet land, dry land and garden land through hands on experience and demonstrations.
2. Identification of different crops in local region
3. Visit to meteorological observatory
4. Visit to wetlands and irrigate dry lands to learn important cropping systems and Hi Tech nursery
5. Seed selection and seed treatment procedures
6. Seed bed and nursery preparation
7. Sowing / Transplanting
8. Biometric observation for crops
9. Nutrient management studies

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10. Water management and irrigation scheduling
11. Weed management studies
12. Integrated Pest Management studies
13 Harvesting
14. Post harvesting

Total : 30 Hours

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U19ENTL101L	COMMUNICATIVE ENGLISH LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

This course aims to provide,

- Improvement in communicative ability and to enhance the general conversational skills in different socio cultural contexts.

Course Outcome:

At the end of the course students will be able to,

CO1 : Listen and comprehend technical and non-technical spoken experts critically and functionally using BEC modules.

CO2 : Write different forms of writing effectively and apparently and create advance level of writing in English.

CO3 : Read different genres of text, analysing and interpreting it by guessing the meaning from the context and employ it for new ideas, to learn and present.

CO4 : Speak fluently using the proper vocabulary, modulation, articulation and pronunciation.

CO5 : Familiarize the soft skills needed for the employability and gaining functional understanding of the language.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	2	2	2	3	-	2	-	-	2
CO2	-	-	-	-	-	-	-	1	2	3	-	2	-	-	2
CO3	-	-	-	-	-	2	-	2	3	3	-	2	-	-	2
CO4	-	-	-	-	-	-	3	2	1	3	-	3	-	-	3
CO5	-	-	-	-	-	3	3	3	3	3	-	3	-	-	3

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Organs of Speech
2. Pronunciation – Vowels
3. Pronunciation – Diphthongs
4. Pronunciation – Consonants
5. Word Transcription
6. Pronunciation tips
7. Word stress
8. Intonation
9. News/ Video clips
10. Conversation
11. Self-introduction (Video Recording)
12. Ted Talks (comprehension and questions)

Total : 30 Hours

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U19PHTL103L	APPLIED PHYSICS FOR CIVIL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

This course aims to provide,

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.
- To make the students to apply the physics concepts to engineering applications.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

CO2 : Enabled to know about the characteristics and the behaviour of various materials in a practical manner.

CO3 : Understand the behaviour of materials at low temperatures and the applications of Super conductivity.

CO4 : Learn an experimental foundation for the theoretical concepts introduced in the lectures.

CO5 : Analyse, interpret and summarize the experimental results.

CO6 : Communicate clearly the understanding of various experimental principles, instruments/setup, and procedure

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	-	-	-	-	-	-	1	-	3	1	-
CO2	3	1	1	2	-	-	-	-	-	-	1	-	3	1	-
CO3	3	1	1	2	-	-	-	-	-	-	1	-	3	1	-
CO4	3	1	1	2	-	-	-	-	-	-	1	-	3	1	-
CO5	3	1	1	2	-	-	-	-	-	-	1	-	3	1	-
CO6	3	1	1	2	-	-	-	-	-	-	1	-	3	1	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments (Any 10 experiments):

1. Determination of rigidity modulus of the material of a wire-Torsional Pendulum
2. Determination of Viscosity of a liquid – Poiseuille's method.
3. Uniform Bending - Determination of Young's Modulus.

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4. Determination of thickness of a thin wire –Air Wedge
5. Determination of wavelength of mercury spectrum – spectrometer grating
6. Basic operation of Logic Gates
7. Laser (i) Determination of Wavelength and (ii) Determination of Particles size analysis
8. V-I characterization of PNP and NPN transistors
9. V-I characterization of Solar Cells
10. Energy band gap using p-n junction
11. Determination of thermal conductivity of a bad conductor by Lee's disc method
12. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.

Total : 30 Hours

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U19CSTL101L	COMPUTATIONAL THINKING AND PROBLEM-SOLVING LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- To write, test, and debug simple programs.
- Use functions for structuring programs.
- Represent compound data using Python lists, tuples, dictionaries.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the syntax and semantics of the C language.

CO2 : Recognize how to develop and implement a program in the C language.

CO3 : Understand the concept of a branching and looping.

CO4 : Develop various forms of data representation and array supported by the C language.

CO5 : Understand string representation and its operations supported by the C language.

CO6 : Implementing function concept with examples.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (Pos)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	2	3	-	-	-	-	-	-	-	2	2	2	-	-
CO3	3	2	2	2	-	-	-	-	2	2	-	2	2	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-	2	-
CO6	3	3	3	2	-	-	-	-	2	2	2	-	-	2	2

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Design an Algorithm, Flow chart for various problems
2. Design an algorithm, a flowchart using sequence
3. Algorithm using selection
4. Algorithm using Boolean logic and number systems
5. Design an algorithm, a flowchart using Repetition
6. Construct an algorithm using List
7. Design an algorithm for encoding and decoding
8. Demonstrate various algorithms using Factoring Techniques
9. Demonstrate various Searching Techniques
10. Demonstrate various sorting techniques
11. Design various algorithms for Recursive problems
12. Construct an algorithm for Text processing.

Total : 30 Hours

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U19CETL101L	INTRODUCTION TO CIVIL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

This course aims to provide,

- Understand basic application of Civil Engineering and their application in equipments.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Use and describe the application of chain surveying in the field.

CO2 : Determine the quality of water used for drinking and construction purposes.

CO3 : Locate the position of field or land using hand held GPS..

CO4 : Acquire knowledge on chaining process and instruments involved in chaining.

CO5 : Understand the various signs and symbols in maps.

CO6 : Comprehend the basic function of various building components.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	1	1	-	2	1	-	1	-	2	3	1	3
CO2	3	2	-	1	3	2	-	-	2	-	-	3	3	2	3
CO3	3	1	2	1	1	1	1	-	2	1	-	3	1	3	1
CO4	3	1	2	1	1	2	-	-	-	-	-	3	3	1	3
CO5	3	1	2	1	1	-	-	-	-	-	-	3	3	1	3
CO6	3	2	2	1	-	2	-	-	-	-	-	3	3	1	3

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Study of signs and symbols in map
2. Finding location land of using GPS
3. Study of chain and its accessories
4. Ranging and marking perpendicular offset using chain
5. Calculation of area using chain and tape
6. Study about basic components of building and its function
7. Determination of pH of drinking water
8. Determination of total solids
9. Determination of dissolved solids
10. Determination of suspended solids

Total : 30 Hours

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U19CETL102L	ENGINEERING GRAPHICS LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- Comprehend the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Sketch engineering objects, lettering and dimensioning by freehand.

CO2 : Create geometric constructions, drawing parallel and perpendicular lines, circles, arcs, tangencies and irregular curves.

CO3 : Apply orthographic projection method to obtain: Multiview and section view of an object.

CO4 : Understand the concept of projection and acquire visualization skills, projection of points

CO5 : Apply good dimensioning practise, by considering the type of dimensioning and correct location.

CO6 : Create 2D and 3D computer drawing: use industry standard Computer Aided Design (CAD) software.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	1	1	-	2	1	-	1	-	2	3	1	3
CO2	3	2	-	1	3	2	-	-	2	-	-	3	3	2	3
CO3	3	1	2	1	1	1	1	-	2	1	-	3	1	3	1
CO4	3	1	2	1	1	2	-	-	-	-	-	3	3	1	3
CO5	3	1	2	1	1	-	-	-	-	-	-	3	3	1	3
CO6	3	2	2	1	-	2	-	-	-	-	-	3	3	1	3

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Introduction to Computer Aided Drafting software packages.
2. Practice on basic elements of a Computer Aided Drafting packages.
3. Practice on features of a Computer Aided Drafting package.
4. Drafting of Solids, Intersection of Solids.
5. Drafting of Perspective views.
6. Drafting of Orthographic views of simple parts.

Total : 30 Hours

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SEMESTER – II

		L	T	P	C
U19ENTL202T	**ENGLISH FOR ENGINEERS (Common to all Programmes)**	**2**	**0**	**0**	**2**

Course Objectives:

- To develop learner's ability to listen and comprehend talks for the application of language in various context.
- To develop the student's ability to use English accurately, appropriately and fluently in different social and professional situations.
- To comprehend advanced technical passages and to identify the author's purpose and tone.
- To enhance advanced level of writing by organizing ideas eand achieving consistency in academic as well as workplace contexts.
- To enhance the technical components of English language for formulating effective and appropriate sentences.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Communicate with one or many listeners using appropriate communicative strategies.

CO2 : Speak clearly, confidently and comprehensively using appropriate communicative strategies.

CO3 : Read different genres of texts adopting various reading strategies.

CO4 : Understand the form and function of the basic official correspondences and perform a range official support through formal and informal writings.

CO5 : Comprehend and apply the language learning strategies to read, comprehend, organize and retain written information.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	**PROGRAMME OUTCOMES (Pos)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	1	2	1	1	3	-	2	-	2	-
CO2	-	-	-	-	-	2	2	2	2	3	-	2	-	2	-
CO3	-	-	-	-	-	3	3	1	2	3	-	3	-	2	-
CO4	-	-	-	-	-	1	1		1	3	-	1	-	3	-
CO5	-	-	-	-	-	3	3	3	3	3	-	3	-	3	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I BASICS OF GRAMMAR 6

Use of the Gerund – Use of the infinite –'Used to' for habitual actions – Degrees of Comparison – Reading Comprehension passage and answering – Essay writing (Narrative / Descriptive / Expository / Persuasive) – Letter Writing (Suggestions / Apology/ Acceptance).

UNIT II FOCUS ON LANGUAGE DEVELOPMENT 6

Modal verbs (Possibility, ability, Permission, Suggestions and obligations obligation) – Simple Past vs Present Perfect – Subject and verb agreement – Interpreting charts / Graphs / Tables – Instructions.

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UNIT III FUNCTIONAL GRAMMAR AND FORMAL WRITING 6

Relative Pronouns for people and things – Future with 'be going to' and 'will' – Personal and impersonal passive – Email writing – Memo writing – Expansion of a Proverb.

UNIT IV EXTENDED WRITING 6

Fixed and Semi-fixed expressions – Wishes and hypotheses – Conditional clauses -Process Description- Notice / Agenda / Minutes of Meeting.

UNIT V TECHNICAL COMMUNICATION 6

Idioms: guessing meaning based on the context – Question Tags – Reported speech – Technical Proposal – Report Writing (Project / Survey).

Total : 30 Hours

Text Books:

T1. Richards, C. Jack. Interchange Students Book-2 New Delhi: CUP, 2015.

T2. Means,L. Thomas and Elaine Langlois. English and Communication For Colleges. Cengage Learning, USA: 2007.

Reference Books:

R1. Redston, Chris & Gillies Cunningham. Face2Face (Upper-intermediate Student's Book). Cambridge University Press, New Delhi: 2005.

R2. Daise, Debra &Charl Norloff. Q:Skills for Success Reading and Writing (2nd Edition). Oxford University Press. 2019.

R3. Sudharshana N Pand Savitha C. English for Technical Communication. Cambridge University Press. 2018.

Web Resources

W1. www.oxfordonlineenglish.com/free-english-pronunciation-lessons
W2. https://www.bbc.co.uk/programmes/n13xtmdc
W3. http://www.cambridge.org/elt/blog/

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U19CHTL205T	ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To create an exposure to the basic concepts of environment, ecosystem and biodiversity.
- To gain basic knowledge about various resources of environment.
- To gain knowledge on environmental pollution, threats and engineering problems for solving environmental issues.
- To acquire knowledge about social issues and green chemistry for sustainable development.
- To know about the human interactions with the environment.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Obtain knowledge on awareness about environmental factors.

CO2 : Find scientific, technological, economic and political solutions to environmental pollution.

CO3 : Gain knowledge on interrelationship between living organism and environment.

CO4 : Assess the impact on the human world envision the surrounding environment, its functions and its value.

CO5 : Obtain knowledge on the dynamic processes and understand the features of the earth's interior nd surface.

CO6 : Understands the integrated themes and biodiversity, natural resources, pollution control and waste management.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (Pos)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO2	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO3	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO5	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO6	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic

and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes,etc.

UNIT II ENVRIONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution € Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects andcontrol measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies –disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATRUAL RESOURCES 10

Forest Resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people. Water Resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problem. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food Resources: World food problems, changes causedby agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy Resources: Growing energy needs, renewable and non renewable energy sources, use of alternateenergy sources. Case studies. Land Resources: Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources forsustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND ENVRIONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, globalwarming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water(Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND ENVIRONMENT 8

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

Total : 45 Hours

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Text Books:

T1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2006.

T2. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Pearson Education, 2004.

Reference Books:

R1. Dharmendra S. Sengar, "Environmental Law", Prentice Hall of India Pvt. Ltd., New Delhi, 2007.

R2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hydrabad, 2015.

R3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt. Ltd., Delhi, 2014.

R4. Rajagopalan.R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005

Web Resources:

W1. https://www.nature.com/scitable/knowledge/library/biodiversity-and-ecosystem-stability-17059965

W2. https://www.eartheclipse.com/environment/types-and-threats-to-natural-resources.html

W3. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-pollution

W4. http://www.scind.org/631/Mindblower/-importance-of-adopting-green-chemistry.html

W5. https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=79926&printable=1

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U19MATH213 **ADVANCED CALCULUS**

L	T	P	C
3	1	0	4

Course Objectives:

- Engineering Mathematics is an essential tool for describing and analysing engineering process and systems. It enables precise representation and communication of knowledge. The objective of the course is to expose students to understand the basics and importance of vector calculus, complex differentiation, complex integration, ordinary differential equations and partial differential equations which are being widely used in Civil Engineering studies.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Apply different methods of integration, integration by parts and to interpret the definite integral of a function geometrically as an area of a region.

CO2 : Gain knowledge to understand gradient, divergent and curl with their application.

CO3 : Distinguish between real and complex function differentiation, applicability of analytic and harmonic nature of complex valued function in Civil Engineering and the study of fluids.

CO4 : Gain knowledge to solve ordinary differential equations arising in Civil Engineering.

CO5 : Acquire knowledge to solve partial differential equations involving in Civil Engineering.

CO6 : Relate and to apply fundamental sciences to learning the essential civil engineering concepts and theories of different branches.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	-	-	-	-	-	2	2	2	1
CO2	3	3	2	-	2	-	-	-	-	-	-	2	2	2	2
CO3	3	3	2	-	2	-	-	-	-	-	-	2	2	2	-
CO4	3	3	2	-	2	-	-	-	-	-	-	2	2	2	2
CO5	3	3	2	-	2	-	-	-	-	-	-	2	2	2	-
CO6	3	3	3	3	2	-	-	-	3	-	-	3	3	3	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTEGRAL CALCULUS AND DOUBLE INTEGRALS 9+3

Definite and Indefinite integrals – Substitution rule – Integration by parts – Double integrals – Area enclosed by a plane curves – Applications of integral calculus.

UNIT II VECTOR CALCULUS 9+3

Scalar and Vector Point functions – Gradient – Directional derivative – Divergence and curl – Irrotational and Solenoidal vector fields – Vector integration – Line Integrals – Applications of Vector calculus.

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UNIT III COMPLEX DIFFERENTIATION 9+3

Analytic functions – Cauchy-Riemann equations – Harmonic functions – Orthogonal properties of analytic functions (excluding proof) – Construction of analytic functions by Milne – Thomson's Method – Conformal transformation : $w = z + c$, cz, $1/z$ – Applications of complex differentiation.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients – Method of variation of Parameters – Cauchy's linear equations – Simultaneous first order linear equations with constant coefficients – Applications of Ordinary Differential Equations.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 9+3

Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of homogeneous type – Applications of partial differential equations.

Total : 60 Hours

Text Books:

T1. Grewal. B. S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.

T2. James Stewart., "Calculus: Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015. [For Unit IV-Sections 5.2,5.4(excluding net change Theorem), 5.5 and 7.1]

Reference Books:

R1. Bali. N. P and Manish Goyal., "A Text book of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt Ltd., 2016.

R2. Glyn James, "Advanced Modern Engineering Mathematics", 5th Edition, Pearson Education – 2018.

R3. Kreyzig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley and sons, 2015.

R4. Peter V. O 'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning India Pvt, Ltd, New Delhi, 2010.

R5. Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

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U19CSTL203T	C PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives

The course aims to provide the students to,

- Write modular programs consisting of structure, functions and pointer concepts.
- Define the files, file manipulations.
- Use structure variables for data storage and manipulation.
- Knowledge about linear data structure.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Explain the syntax for C programming.

CO2 : Associate the program in 'C' for real world situation.

CO3 : Apply the concepts of Arrays, Strings in 'C' language for user defined problems.

CO4 : Apply the concept of functions and pointers.

CO5 : Associate the programme with structure using 'C' language.

CO6 : Discuss to read and write data from to files in 'C' Program.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	1	1	2	-	-	-	-	-	-	-	2	3	1
CO3	3	2	2	1	3	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	1	3	-	-	-	-	-	-	-	2	2	-
CO5	3	1	1	1	2	-	-	-	-	-	-	-	2	2	-
CO6	3	1	1	1	2	-	-	-	-	-	-	-	1	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION: C PROGRAMMING 9

Structure of C program, Comments, Data types, Variables, Tokens: Keyword, Identifier, Constants, Operators, Expression and evaluation, Input and Output statements, Decision making – statements, Iterative statements, Storage Classes: auto, register, static and extern, Pre-processor Directives.

UNIT II ARRAYS AND STRING 9

Introduction to arrays: Declaration, Initialization. One dimensional array Multi-dimensional arrays, Searching: Linear and Binary Search, Sorting: Bubble sort, Selection Sort. Introduction to string, Built in string functions, String manipulation with and without built in functions, Array of strings, Pattern matching application using strings.

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UNIT III FUNCTIONS AND POINTERS 9

Introduction to functions, Function prototype, Function definition, Function call, User defined functions and Standard functions (math function), Parameter passing: Call by value, Call by reference, Recursive functions, Passing arrays to functions, Command line arguments. Pointer in C, Importance of pointer, Types of pointer, Pointer expression and arithmetic, Pointer and array, String as pointer, Pointer to function, Dynamic Memory Allocation.

UNIT IV USER DEFINED DATATYPES 9

Structure: Declaration, Accessing structure elements, Array of structure, Nested structure, Pointers to structure, Structure to function, typedef vs #define. Union: Declaration, Accessing union elements, Difference between structure and union, Enum and its uses.

UNIT V FILE HANDLING 9

Introduction to file, File Operations: Create, Open: File modes, Read, Write, Move, Close, File Processing: Sequential access and Random access.

Total : 45 Hours

Text Books:

T1. Programming in C, Ashok N. Kamthane, 2nd Edition, Pearson Education India, 2011.

T2. Behrouz A. Forouzan and Richard F. Filberg, "Computer Science A Structures Programming Approach using C", 3rd Edition, Cengage Learning, 2006.

Reference Books:

R1. A first book of ANSI C by Gray J. Brosin 3rd edition Cengage delmer Learning India Pvt. Ltd

R2. Pradip Dey, Manas Ghosh, "Programming in C", 2nd edition, Oxford University Press, 2011

R3. Seyed H Roosta, "Foundations of programming languages design & implementation", Cengage Learning. 2009.

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U19CETH203	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the student to,

- Apply their knowledge of mathematics, science in engineering problems.
- To expand their knowledge on Rigid body Mechanics.
- Prepare for Higher level course such Mechanics of Materials and Structural Analysis.

Course Outcomes:

At the end of the course students will be able to,

CO1: Compute the equilibrium of rigid bodies in two dimensions and three dimensions

CO2: Illustrate the vectorial and Scalar representation of forces and moments.

CO3: Solve Problems of simple systems with sliding friction and calculate linear and angular acceleration of moving body in general plane motion.

CO4: Acquire Knowledge regarding centre of gravity and moment of inertia and apply them for practical problems

CO5: Identify motion and determine the velocity and acceleration of particle.

CO6: Apply the principles of Kinetics in Solving problems in dynamics.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	-	1	-	-	-	2	-	3	3	3	1
CO2	2	1	1	2	-	-	-	-	-	-	-	3	3	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3	1
CO4	3	3	-	2	-	1	-	-	-	2	-	3	3	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	1	-
CO6	3	3	2	2	-	1	-	-	2	1	-	3	3	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I BASICS OF STATICS 9

Fundamental Principles – Coplanar forces – Resolution and Composition of forces and equilibrium of particles – Forces of a particle in space – Equivalent system of forces – Principle of transmissibility – Single equivalent force – Equilibrium of rigid bodies in two dimensions and three dimensions – Moments and Couples – Moment of a force about a point and about an axis – Varignon's theorem.

UNIT II FRICTION 9

Frictional resistance – classification of friction – laws of friction – Dry friction – wedge friction – ladder friction – rolling resistance.

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UNIT III PROPERTIES OF SURFACE AND SOLIDS 9

Centroid – First moment of area – Second moment of area – Moment and product of inertia of plane areas – Transfer Theorems – Polar moment of inertia – Principal axes – Mass moment of inertia.

UNIT IV BASICS OF DYNAMICS – KINEMATICS 9

Kinematics – displacements, velocity and acceleration – Equation of motion – Rectilinear motion of a particle with uniform velocity, Uniform acceleration, varying acceleration – motion curves – motion under gravity – relative motion – projectiles – angle of projection – range – time of flight and maximum height.

UNIT V BASICS OF DYNAMICS – KINETICS 9

Newton's second law of motion – D'Almbert's principle, Dynamics of equilibrium – work energy method. Principle of impulse and momentum – Equation of momentum – Laws of conservation of momentum. Impact – types of impact – collision of elastic bodies by direct central impact and obliques impact – collision of small body with a massive body.

Total : 45 Hours

Text Books:

T1. Vela Murali, "Engineering Mechanics", Oxford University Press, 2010.

T2. R.K. Bansal. "Engineering Mechanics and Strength of Materials", Laxmi Publication, 2017.

T3. S.C. Natesan, "Engineering Mechanics", Umesh Publications, New Age International Pvt ltd, 2014.

Reference Books:

R1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.

R2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", Pearson Education 2014.

R3. Rajasekaran S and Sankara subramanian G, "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt Ltd., India, 2013.

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U19CETL204T BUILDING PLANNING AND ARCHITECTURE

L	T	P	C
2	0	0	2

Course Objectives:

This course aims to provide the students to,

- Gain knowledge on the principles and functional design of buildings relating to the environment.
- Identify various types of buildings and their planning concepts.
- Acquire knowledge of the design of landscapes.

Course Outcomes:

At the end of the course students will be able to,

CO1: Plan and design of large-scale buildings with high degree of complexity by understanding architectural, socio-cultural, and economic issues connected with architecture.

CO2 : Ability to plan any civil engineering project by incorporating various aspects of environment of the project area.

CO3 : Acquire knowledge on various principles of building architecture and climatic factors affecting the buildings.

CO4 : Gain knowledge on safety standards in building.

CO5 : Identify and perform site analysis.

CO6 : Design the elements of landscapes.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	1	-	2	2	-	-	-	-	3	2	-	1
CO2	3	2	1	-	-	3	3	2	-	-	-	2	2	1	-
CO3	2	1	3	-	1	2	3	-	-	1	-	3	-	1	-
CO4	-	-	-	2	1	1	-	-	-	-	-	2	3	2	2
CO5	3	1	-	1	-	1	-	-	-	-	-	3	3	2	2
CO6	2	1	3	-	1	-	2	-	1	-	-	3	3	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I PRELIMINARY INVESTIGATION 6

Principles of Planning – Planning regulations and bye laws – Site works and setting out – Excavation and Timbering – Sub soil drainage – Electricity lighting on building areas – Winter building – Preparation of layout – Site plan – Orientation of buildings.

UNIT II ARCHITECTURE AND CLIMATE RESPONSIVE DESIGN 6

Architectural design – an analysis – Integration of function and aesthetics – introduction of basic and principles of design. Factors that determine climate – Characteristics of climate types – Design of various climate types – Passive and active energy controls.

UNIT III BUILDING TYPES AND SAFETY 6

Residential, institutional, commercial and Industrial – Planning concepts – Application of anthropometry and space standards – Inter relationships of functions – Safety standards – Building rules and regulations – Integration of building services.

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UNIT IV SITE PLANNING 6

Surveys – site analysis – Development control – zoning regulations – Layout regulations – urban planning standards – Layout design concepts.

UNIT V LANDSCAPES 6

Traditional and contemporary landscapes – Principles of landscape design – Urban renewal – Elements in urban landscapes – Conservation – Case studies.

Total : 30 Hours

Text Books:

T1. Franics D.K Ching, "Architecture – Form, Space and Order", John Wiley & Sons. Inc., 2007.

T2. Steven V. Szokolay, "Introduction to Architectural Science – The basis of sustainable Design", Elsevier – 2007.

Reference Books:

R1. Muthu Shobha Mohan, "Principles of architecture". Oxford University Press, 2006.

R2. Koenigeberger, "Manual of Tropical housing and Building – Climate Change", Universities Press, 2010.

R3. Bureau of Indian standard Handbook on Functional Requirement of Buildings – SP:41 (S and T) – 1987.

R4. Narasimham V, "An Introduction Building Physics", Kabeer Printing works, Chennai, 1974.

R5. Krishnan, "Climate Responsive Architecture", Tata McGraw Hill, 1999.

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U19CCEX202	ENGINEERING EXPLORATION – II	L	T	P	C
		1	0	2	2

Course Objectives:

This course aims to provide the students,

- To enable the students to design and build simple systems on their own.
- To help experiment with innovative ideas in design and team work.
- To create an engaging and challenging environment in the engineering lab.
- To inculcate ethics and sustainability perspectives and enable students to work in a team.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the role of an engineer as a problem solver.
CO2 : Apply multi-disciplinary principles and build systems using engineering design process.
CO3 : Use appropriate tools for designing and development of solutions.
CO4 : Analyse engineering solutions from ethical and sustainability perspectives.
CO5 : Use basics of engineering project management skills while doing projects.
CO6 : Communicate, Collaborate and work as a team.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	1	-	-	-	-	-	-	-	-	2	1	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO3	-	-	3	3	3	-	-	-	-	-	-	2	3	3	-
CO4	-	-	-	-	-	3	3	3	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	3	3	2	-	3	2
CO6	-	-	-	-	-	-	-	-	3	3	3	2	-	2	2

(3 – High, 2 – Medium, 1 – Low)

Contents:

S.No	Topics	No. of Hours
1.	Introduction to Engineering	3
2.	Platform based development	12
3.	Mechanism	9
4.	Requirements	3
5.	Design	
6.	Ethics	6
7.	Sustainability	
8.	Project Management Principles	3
9.	Guided Projects	
10.	Final Projects	9

`

Guidelines:

1. Practical based learning carrying credits.
2. Multi-disciplinary / Multi focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students
5. The students have to display their model at the end of semester
6. The progress of the course is evaluated based on class performance and final demonstration of prototype

Total : 45 Hours

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U19ENTL202L	ENGLISH FOR ENGINEERS LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

This course aims to provide,

- Training to use language effectively to face interviews, group discussions and public speaking.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Communicate with one or many listeners using appropriate communicative strategies.

CO2 : Speak clearly, confidently and comprehensively using appropriate communicative strategies.

CO3 : Read different genres of texts adopting various reading strategies.

CO4 : Understand the form and function of the basic official correspondences and perform a range official support through formal and informal writings.

CO5 : Comprehend and apply the language learning strategies to read, comprehend, organize and retain written information.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	2	1	1	3	-	2	-	2	-
CO2	-	-	-	-	-	2	2	2	2	3	-	2	-	2	-
CO3	-	-	-	-	-	3	3	1	2	3	-	3	-	2	-
CO4	-	-	-	-	-	1	1		1	3	-	1	-	3	-
CO5	-	-	-	-	-	3	3	3	3	3	-	3	-	3	-

List of Experiments:

1. Telephone conversation.
2. One Minute Talk (Prepared).
3. Describing a holiday / festivals / special events.
4. BBC Hard Talk / NDTV Big Fight.
5. Impromptu Speech.
6. Story writing.
7. Story telling.
8. Open ended stories.
9. Peacha Kucha.
10. Book Review.
11. Blog writing.
12. TED Talk Presentation.

Total : 30 Hours

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U19CHTL205L	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- Practical skills in the determination of water quality parameters through volumetric and instrumental analysis.

Course Outcomes:

At the end of the course students, will be able to,

CO1 : Gain hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

CO2 : Estimate the impurities present in water.

CO3 : Estimate the ions/metal ions present in the water.

CO4 : Utilize the fundamental laboratory techniques for analyses such as titrations, separation / purification and spectroscopy.

CO5 : Analyse and gain experimental skills.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	2	2	-	-	-	-	-	3	2	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	1	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	1	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Estimation of iron content of the water sample by potentiometric titration.
2. Determination of Dissolved Oxygen content of water sample by Winkler's method.
3. Comparison of the conductivity, Ph & TDS of various types of water (municipal water, distilled water, salt water, waste water).
4. Determination of corrosion rate of steel in acid media by weight loss method
5. Proximate analysis of coal – determination of moisture, volatile matter, ash and fixed carbon.
6. Determination of strength of HCl using Conductivity meter.
7. Determination of strength of HCl using Ph meter.
8. Estimation of Sodium and Potassium by flame photometry.
9. Estimation of Heavy metal by Calorimetry.
10. Determination of moisture content of soil samples.

Total: 30 hours

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U19STL203L	C PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- Create structure variables for data storage and manipulation.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Explain the syntax for C programming.
CO2 : Associate the program in 'C' for real world situation.
CO3 : Apply the concepts of Arrays, Strings in 'C' language for user defined problems.
CO4 : Apply the concept of functions and pointers.
CO5 : Associate the programme with structure using 'C' language.
CO6 : Discuss to read and write data from to files in 'C' Program.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	1	1	2	-	-	-	-	-	-	-	2	3	1
CO3	3	2	2	1	3	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	1	3	-	-	-	-	-	-	-	2	2	-
CO5	3	1	1	1	2	-	-	-	-	-	-	-	2	2	-
CO6	3	1	1	1	2	-	-	-	-	-	-	-	1	2	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Solve some mathematical and scientific problems using functions.
2. Solve problems using arrays.
3. Create a program using recursive functions.
4. Demonstrate various predefined string functions.
5. Manipulate string using users defined functions.
6. Solve problems using pointers.
7. Develop a C program using Enum data type.
8. Design a C program using typedef
9. Create programs using structure and unions.
10. Develop a C program using Dynamic Memory Allocation.
11. File handling in sequential access.
12. File handling in random access.

Total : 30 Hours

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U19CETL204L	BUILDING PLANNING AND ARCHITECTURE LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- An exposure to the students with hands on experience on various basic engineering practises in Civil Engineering.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Apply the knowledge on basics of planning for building.
CO2 : Fabricate carpentry components and pipe connections including plumbing works.
CO3 : Comprehend various components of plumbing works.
CO4 : Use welding equipments to join the structure.
CO5 : Wiring work for residential buildings and other buildings.
CO6 : Understand the difference between voltage, current.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	2	-	-	-	1	-	2	1	-	-
CO2	3	3	3	2	-	-	-	-	-	1	-	2	3	3	-
CO3	3	3	3	3	3	-	-	2	-	1	-	2	3	3	-
CO4	3	3	3	3	-	-	-	-	-	2	-	3	3	-	-
CO5	3	3	3	3	1	-	-	-	-	2	-	3	3	-	-
CO6	3	3	3	3	-	-	-	-	-	-	-	3	3	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Study of plumbing and carpentry components of residential buildings
2. Study of pipelines joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands on exercise: Pipe connections with different joining components
5. Demonstration of Plumbing requirements of high-rise buildings
6. Study of the joints in roofs, doors, windows and furniture.
7. Hand on exercise: Wood works, joint by sawing, planning and cutting.
8. Residential house wiring.
9. Stair case wiring.
10. Measurement of electrical quantities: Voltage, Current, Power & Power factor in RLC circuit.

Total : 30 Hours

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SEMESTER – III

		L	T	P	C
U19MATH321	**PROBABILITY, STATISTICS AND OPTIMIZATION TECHNIQUES**	**3**	**1**	**0**	**4**

Course Objectives:

- Introduce the basic concept of probability, random variables and probability distributions and two-dimensional discrete random variable and the relationship between them by using correlation and linear regression. Understand the testing techniques of the samples against the population and familiar with analysis of variance and its applications. The objective of the course is to expose students to the knowledge of linear programming problem and Network diagram in Optimization Techniques.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Apply the concepts of correlation and regression for solving Engineering problems.
CO2 : Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO3 : Identify the classification of the design of experiments and solve the Engineering problems by using the ANOVA techniques.
CO4 : Identify linear programming problems and apply its techniques for solving the Engineering problems.
CO5 : Apply optimization techniques for scheduling and solving problems the Engineering Field.
CO6 : Apply methods of estimation, linear corelation & regression analysis, Goodness of fit and for independence of attributes.

Course Articulation Matrix:

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**		
CO s	**PROGRAMME OUTCOMES (Pos)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	-	2	-	-	-	-	-	-	2	2	2	2
CO2	2	2	2	-	2	-	-	-	-	-	-	2	2	2	2
CO3	2	2	3	-	2	-	-	-	-	-	-	2	3	3	2
CO4	3	3	2	-	2	-	-	-	-	-	-	2	3	3	2
CO5	3	3	2	-	2	-	-	-	-	-	-	2	3	3	2
CO6	3	3	2	3	2	-	-	-	-	-	-	3	3	3	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I TWO – DIMENSIONAL DISCRETE RANDOM VARIABLES 11+3

Random variables (concept only) – Two dimensional discrete random variables – Joint distributions – Marginal and conditional distributions – Correlation and Linear regression (discrete data only) – Applications of two dimensional discrete random variables in Civil Engineering.

`

UNIT II TESTING OF HYPOTHESIS 9+3

Sampling distributions – Statistical hypothesis – Large sample tests based on Normal distribution for single mean and difference of mean – Small sample tests based on t for single mean, and difference of means, F distributions for difference of variances and Chi square test for independence of attributes – Applications of testing of hypothesis in Civil Engineering.

UNIT III DESIGN OF EXPERIMENTS 9+3

One way and two – way classifications – Completely randomized design – Randomized block design – Latin square design – Applications of design of experiments in Civil Engineering.

UNIT IV LINEAR PROGRAMMING 9+3

Linear programming introduction – Linear programming formulation of Transportation problem (concepts only) – Solution of Transportation problem: North West corner rule – Vogel's approximation method – MODI method – Assignment problem – Hungarian method – simple problems – Applications of linear programming in Civil Engineering.

UNIT V OBJECT SCHEDULING 7+3

Network diagram representation – Critical path method – Time charts and resource levelling – PERT – Applications of object scheduling in Civil Engineering.

Total : 60 Hours

Text Books

T1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4 th Edition, 2007.

T2. Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.

T3. H.A. Taha, "Operation Research", Prentice Hall of India, 2002.

Reference Books

R1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.

R2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

R3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.

R4. Paneer Selvam, "Operations Research", Prentice Hall of India, 2006.

R5. Anderson. "Quantitative Methods for Business", 13th Edition, Thomson Learning, 2016.

R6. Winston, "Operation Research", Thomson Learning, 2004.

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U19CETL305T	MECHANICS OF MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students to,

- Basic concepts and principles of Mechanics of Materials.
- Ability to calculate the stresses and deformation of objects under external loading condition.
- Determine the internal forces and analyses the stresses of various structural elements under action of different types of forces.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Apply the fundamental concepts of stress and strain in the analysis of various structural elements.
CO2 : Determine the bending and shear stress produced in the beam and understand the Concepts of theory of simple bending.
CO3 : Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.
CO4 : Apply basic equation of torsion in design of Circular shafts and helical springs.
CO5 : Analyse the pin jointed plane and space trusses.
CO6 : Able to solve a variety of engineering problems that involves mechanics of materials.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	2	-	-	-	-	-	2	3	1	1
CO2	3	3	-	2	-	2	-	-	-	-	-	-	3	1	1
CO3	3	3	-	2	-	2	-	-	-	-	-	1	3	1	1
CO4	3	3	-	2	-	2	-	-	-	-	-	2	3	1	1
CO5	3	3	-	2	-	2	-	-	-	-	-	2	3	1	1
CO6	3	3	3	2	-	2	-	-	-	-	-	-	3	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I STRESS, STRAIN AND ELASTIC CONSTANTS 9

Stress and Strain: Concept of statical determinacy and indeterminacy – Thermal Stresses – Stresses in Composite section – stresses in varying cross section. Elastic Constants – Modulus of rigidity and Bulk modulus – Relation between E, G and K Stress – strain diagrams for brittle and ductile materials – working stress – Strain energy due to impact loading – pure shear.

UNIT II SHEAR FORCE AND BENDING MOMENT OF BEAM 9

Types of supports – Types of determinate beams – Simply supported, Cantilever, Overhanging and compound beams with articulations – Shear Force and Bending Moment diagrams – Principles of Superposition. Theory of Simple Bending: Assumptions – Theory of Simple Bending – Bending stresses in determinate beams – Shear and bending stresses distribution at a cross section with different loading conditions – Flitched Beams.

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UNIT III DEFLECTION OF BEAM **9**

Double Integration method, Macaulay's method, Moment area method, Conjugate Beam method – Calculation of Slope and deflections of statically determinate beams.

UNIT IV TORSION **9**

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – combined bending moment and torsion of shafts – Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel – Design of buffer springs.

UNIT V ANALYSIS OF TRUSSES **9**

Determinate and indeterminate trusses – Analysis of pin jointed plane determinate trusses by method of joints, method of sections.

Total : 45 Hours

Text Books

T1. Rajput. R.K. "Strength of Materials", S. Chand and Co, New Delhi, 2018.

T2. Punmia. B.C., Ashok Kumar Jain and Arun Kumar Jain, "Mechanics of Material", Laxmi publications, New Delhi, 2019.

T3. Bansal. R.K. "Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi, 2017.

Reference Books

R1. T.D. Gunneswra Rao and Mudimby Andal, "Strength of Materials – Fundamentals and Applications", Cambridge University Press, 2018.

R2. Singh. D.K., "Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2016.

R3. Junnarkar. S.B. and Shah. H.J, "Mechanics of Structures Vol – I", Charotar Publishing House, New Delhi 2016.

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U19CETL306T **FLUID MECHANICS**

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provide the students to,

- Develop understanding about hydrostatic law, the principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
- Inculcate the importance of fluid flow measurement and its applications in Industries
- Determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the properties of fluid and analyse the stability of floating and submerged bodies.
CO2 : Solve problems related to equation of motions.
CO3 : Understand the fluid flow behaviour through pipes and apply the working concepts of various devices used to measure the velocity and discharge of fluid.
CO4 : Formulate the functional relationship that exists between dependent and independent variable of fluid flow.
CO5 : Assess the concept of boundary layer separation, circulation, drag and lift on immersed bodies.
CO6 : Acquire knowledge to calculate and design engineering applications involving fluids.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	2	-	2	3	2	2
CO2	3	3	2	3	2	-	-	-	-	2	-	2	3	2	2
CO3	3	3	2	3	2	-	-	-	-	1	-	2	3	2	2
CO4	3	3	2	3	-	-	-	-	-	1	-	2	3	2	2
CO5	3	3	2	3	2	-	-	-	-	1	-	2	3	2	2
CO6	3	3	2	3	2	-	-	-	-	1	-	2	3	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I FLUID PROPERTIES AND FLUID STATICS **9**

Fluid – definition, distinction between solid and fluid – Units and dimensions – Properties of fluids – Fluid statics: concept of fluid static pressure, absolute and gauge pressures – pressure measurements by manometers – forces on planes – centre of pressure – buoyancy and floatation.

UNIT II FLUID KINEMATICS AND DYNAMICS **9**

Fluid Kinematics – Classification and types of flow – velocity field and acceleration – continuity equation (one- and three-dimensional differential forms) – stream line – streak line – path line- stream function – velocity potential function – flow net. Fluid Dynamics – Euler and Bernoulli's equations – orifice meter, Venturimeter, Momentum equation, Application of momentum equation.

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UNIT III FLOW THROUGH PIPES 9

Measurement in pipe flow – Major loss – Darcy Weisbach equation, Moody's diagram – Minor losses – Hagen Poiseuille equation – Pipes in Series and Parallel.

UNIT IV DIMENSIONAL ANALYSIS 9

Dimensional homogeneity – Raleigh's method – Buckingham π theorem – Non-dimensional numbers – Model laws and distorted models – Modelling and similitude.

UNIT V BOUNDARY LAYER FLOW 9

Boundary layer – definition – boundary layer on a flat plate – laminar and turbulent boundary layer displacement, energy and momentum thickness – Momentum integral equation-Boundary layer separation and control – drag on flat plate.

Total : 45 Hours

Text Books

T1. Bansal. R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 2018.

T2. Modi P.N and Seth, "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2019.

T3. Subramanya. K, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2013.

Reference Books

R1. Jain.A.K.., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.

R2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press, New Delhi, 2015.

R3. Fox W.R. and McDonald A.T., "Introduction to Fluid Mechanics", John-Wiley and Sons, Singapore, 2013.

R4. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.

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U19CETL307T **SURVEYING**

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provide the students to,

- Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.
- Translate the knowledge gained for the implementation of Civil infrastructure facilities.
- Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Calculate angles and distances using various surveying instruments.
CO2 : Understand levelling (auto level, theodolite) and using it in field of construction. Further draw contours to represent 3D data on plane figures.
CO3 : Perform angular measurement, elevation and distance of the object.
CO4 : Design and implement different types of curves for deviating type of alignments, and applying surveying techniques to align highway and railway curves.
CO5 : Understand the concepts and principles of modern surveying.
CO6 : Analyse type of survey operation required for problem solving in field to perform.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (Pos)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3	1	-
CO2	3	2	3	-	3	-	-	-	-	-	-	2	3	-	2
CO3	3	2	3	-	-	2	-	-	-	-	-	2	-	1	2
CO4	3	2	-	-	3	3	-	-	-	2	-	2	-	1	-
CO5	3	2	-	-	3	-	-	-	-	2	-	2	3	1	2
CO6	3	2	3	2	-	-	-	-	1	-	-	2	3	-	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUTION AND BASIC CONCEPTS 9

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying.

Measurement of Distances and Directions:

Linear distances – Approximate method, Direct methods – Chain, Tapes, Ranging, Tape corrections – Indirect method – optical methods – EDM method.

Prismatic Compass – Bearings, included angles, Local attraction, Magnetic Declination and dip.

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UNIT II LEVELLING AND CONTOURING 9

Levelling- Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method – Rise and Fall method, Effect of Curvature of Earth and Refraction. **Contouring-** Characteristics and uses of Contours, Direct & Indirect methods of contour surveying, interpolation and sketching of Contours. **Computation of Areas and Volumes Areas –** Determination of areas consisting of irregular boundary and regular boundary (coordinates, MDM, DMD methods), Planimeter. **Volumes –** Computation of areas for level section and two level sections with and without transverse slopes, determination of volume of earth work in cutting and embankments, volume of borrow pits, capacity of reservoirs.

UNIT III THEODOLITE AND TRAVERSING 9

Theodolite Surveying: Types of Theodolites, Fundamental Lines, Temporary adjustments, Measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

UNIT IV TACHEOMETRIC SURVEYING AND CURVES 9

Tacheometric Surveying: Principles of Tacheometry, stadia and tangential methods of Tacheometry.

Curves: Types of curves and their necessity, elements of simple curve, setting out of simple Curves, Introduction to compound curves.

UNIT V MODERN SURVEYING METHODS 9

Total Station and Global Positioning System: Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic wave theory – electromagnetic distance measuring system – principle of working and EDM instruments, Components of GPS – space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS.

Total : 45 Hours

Text Books

T1. Kanetkar. T.P and Kulkarni. S.V, "Surveying and Levelling – Parts 1 & 2", Pune Vidyarthi Griha Prakashan, Pune, 2014.

T2. Punmia. B.C., Ashok K Jain and Arun K Jain, "Surveying Vol. I & II", Lakshmi Publications Pvt Ltd, New Delhi, 2019.

T3. Basak N N, "Surveying & Levelling", Tata McGraw-Hill Education, 2017.

Reference Books

R1. Duggal S K., "Surveying Vol – I and II", McGraw Hill Education (India) Private Limited, 2019.

R3. Madhu, N, Sathiskumar, R and Satheesh Gobi, "Advanced Surveying: Total Station, GIS and Remote Sensing", Pearson India, 2017.

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U19CETL308T	CONSTRUCTION MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives

This course aims to provide the students to,

- Identify various construction materials used in Civil Engineering industry.
- Analyse the quality and properties of construction materials used in the industry.
- Understand the application of various modern construction materials in industry.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Compare the properties of common building materials used in construction.
CO2 : Understand the typical and potential applications of cement and aggregates.
CO3 : Know about the various types of steel available in market and its application in construction.
CO4 : Understand the applications of timbers and other materials.
CO5 : Identify the importance of modern material for construction.
CO6 : Demonstrate the ability to know about different materials such as stones, bricks, Tiles, wood, aluminium, glass & paints and their classification , manufacture and structural requirements.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	2	-	-	-	-	2	3	1	1
CO2	2	2	-	-	2	-	2	-	-	-	-	2	3	1	1
CO3	2	2	3	-	2	-	2	-	-	-	-	2	3	1	1
CO4	2	2	3	-	1	-	2	-	-	-	-	2	3	1	1
CO5	2	2	3	-	-	-	2	-	-	-	-	2	3	1	1
CO6	2	2	3	-	2	-	-	-	-	-	-	2	3	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I STONES, TILES, BRICKS, BUILDING BLOCKS 9

Stones – Types – characteristics – uses – Tiles – types – selection – suitability – uses – maintenance – Bricks – composition – manufacture – types – BIS tests. Hollow concrete blocks, Burnt clay hollow Blocks, Stabilized mud blocks – Selection of Building Blocks.

UNIT II MATERIALS FOR MORTAR AND CONCRETE 9

Cement – Manufacturing of cement – hydration – setting and Hardening – Preparation and uses of cement mortar. Fine aggregate – Test conducted on fine aggregate – Selection of fine aggregate – properties of M sand. Coarse aggregate – Test conducted on fine aggregate – Selection of fine aggregate. Water – test conducted on water – requirement of water quality.

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UNIT III STEEL 9

Steel Properties – types – manufacturing of steel, market forms of steel – application – angle section, channel section, T-section, I-section, round bars, ribbed mild steel bars and bars for reinforcement

UNIT IV TIMBER, BOARDS AND PAINTS 9

Timber- defects-causes of decay – seasoning – preservation – fire proofing – Laminated wood products – types – properties – uses of fibre boards, particle boards, hard boards and A.C boards – Paints – types – Wall paints – wood paints – metal paints.

UNIT V MODERN BUILDING MATERIALS 9

Aluminium products – UPVC – crack fillers – light roofing materials – GI Sheets – Glass – water proofing compounds – Neo-prene – thermocole – decorative panels and laminates – architectural glasses and ceramics – PVC – fibre reinforced plastic – smart concrete and smart bricks.

Total : 45 Hours

Text Books:

T1. Varghese. P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2018.

T2. S.C. Rangawala, "Engineering materials", Charotar Publishing House, New Delhi.2019.

T3. Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2014.

T4. Duggal. S.K., "Building Materials", New Age International, 2019.

Reference Books

R1. Jagadish. K.S, "Alternative Building Materials Technology", New Age International, 2017.

R2. Gambhir. M.L., & Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2014.

R3. Gambhir. M.L., "Concrete Technology", Tata McGraw Hill Education, 2013.

R4. B.C.Punmia, "Building Construction", Laxmi Publications, New Delhi. 2019.

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U19CETL309T	ENGINEERING GEOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students to,

- Able to learn the significance of earth and minerals.
- Apply geological principles for the mitigation of natural hazards and select sites for construction.
- Apply geology knowledge in Civil Engineering construction.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies.
CO2 : Gain basic knowledge on properties of minerals.
CO3 : Identify types of rocks, their distribution and uses.
CO4 : Understand the methods of study on geological structure.
CO5 : Apply the knowledge on geological investigation in projects such as dams, tunnels, bridges, roads, airport and harbour.
CO6 : Understand scope of engineering geology and identify different types of rocks, minerals and building stones.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	-	3	1	2	-	-	-	-	1	3	-	2
CO2	2	1	-	-	-	-	2	-	-	-	-	1	3	3	-
CO3	2	1	2	-	-	-	2	-	-	-	-	1	3	2	-
CO4	2	1	2	-	-	-	2	-	-	-	-	1	3	2	-
CO5	2	1	-	-	3	2	2	-	-	-	-	1	3	-	3
CO6	2	1	2	-	-	1	-	-	-	-	-	1	3	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I PHYSICAL GEOLOGY 9

Geology in civil engineering – branches of geology – structure of earth and its composition weathering of rocks – scale of weathering – soils – landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India.

UNIT II MINEROLOGY 9

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene – hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

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UNIT III PETROLOGY 9

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble,
Slate, Gneiss and Schist.

UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS 9

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to Civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

UNIT V APPLICATION OF GEOLOGICAL INVESTIGATIONS 9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings – Hydrogeological investigations and mining – Coastal protection structures. Investigation of Landslides, causes and mitigation.

Total : 45 Hours

Text Books:

T1. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2019.

T2. Venkat Reddy. D. “Engineering Geology”, Vikas Publishing House Pvt. Lt, 2017.

T3. Parbin Singh. A “Text book of Engineering and General Geology”, Katson publishing house, Ludhiana 2010.

Reference Books:

R1. Blyth F.G.H. and de Freitas M.H., “Geology for Engineers”, Edward Arnold, London, 2014.

R2. Gokhale KVGK, “Principles of Engineering Geology”, B.S. Publications, Hyderabad 2014

R3. Chenna Kesavulu N. “Textbook of Engineering Geology”, Macmillan India Ltd., 2009.

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U19CCEX303	ENGINEERING EXPLORATION – III	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide the students,

- To enable the students to design and build simple systems on their own.
- To help experiment with innovative ideas in design and team work.
- To create an engaging and challenging environment in the engineering lab.
- To inculcate ethics and sustainability perspectives and enable students to work in a team.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the role of an engineer as a problem solver.
CO2 : Apply multi-disciplinary principles and build systems using engineering design process.
CO3 : Use appropriate tools for designing and development of solutions.
CO4 : Analyse engineering solutions from ethical and sustainability perspectives.
CO5 : Use basics of engineering project management skills while doing projects.
CO6 : Communicate, Collaborate and work as a team.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	1	-	-	-	-	-	-	-	-	2	1	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO3	-	-	3	3	3	-	-	-	-	-	-	2	3	3	-
CO4	-	-	-	-	-	3	3	3	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	3	3	2	-	3	2
CO6	-	-	-	-	-	-	-	-	3	3	3	2	-	2	2

(3 – High, 2 – Medium, 1 – Low)

Contents:

S.No	Topics	No. of Hours
1.	Introduction to Engineering	3
2.	Platform based development	12
3.	Mechanism	9
4.	Requirements	3
5.	Design	
6.	Ethics	6
7.	Sustainability	
8.	Project Management Principles	3

`

9.	Guided Projects	
10.	Final Projects	9

Guidelines:

1. Practical based learning carrying credits.
2. Multi-disciplinary / Multi focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students
5. The students have to display their model at the end of semester
6. The progress of the course is evaluated based on class performance and final demonstration of prototype

Total : 30 Hours

`

U19CETL305L MECHANICS OF MATERIALS LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- Exposure to students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Evaluate the properties of materials by universal testing machine.
CO2 : Evaluate the properties of materials by torsion machine.
CO3 : Evaluate the properties of materials by spring testing machine.
CO4 : Evaluate Impact resistance of materials.
CO5 : Evaluate the properties of material by tensile test.
CO6 : Evaluate the properties of materials by hardness test.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	2	-	1	-	2	-	-	2	3	2	2
CO2	3	2	3	1	2	-	1	-	2	-	-	3	3	2	1
CO3	3	3	3	-	2	-	2	-	2	-	-	3	3	-	3
CO4	3	3	3	-	2	-	-	-	-	-	-	3	2	-	1
CO5	3	3	3	1	2	-	-	-	1	-	-	3	2	1	1
CO6	3	3	3	1	2	-	-	-	1	-	-	3	1	1	1

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Tension test on mild steel rod.
2. Torsion test on mild steel rod.
3. Impact test on metal specimen by Izod test.
4. Impact test on metal specimen by Charpy test.
5. Hardness test on metals – Rockwell.
6. Hardness test on metals – Brinell.

Total : 30 Hours

`

U19CETL306L	FLUID MECHANICS LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- Exposure to students to the testing of different properties of fluids experimentally in Laboratory.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the basic physics of fluids.
CO2 : Gain knowledge to calculate and design engineering applications involving fluid.
CO3 : Discuss and practice standard measurement techniques of fluid mechanics and their applications.
CO4 : Compare the results of analytical models introduced in lecture to the actual behaviour of real fluid flows.
CO5 : Understanding of analysing flow systems in terms of mass, momentum, and energy balance.
CO6 : Work on small design projects.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	-	-	-	-	-	1	-	2	3	1	1
CO2	3	2	1	3	1	-	-	-	1	1	-	3	3	1	1
CO3	3	3	2	1	2	-	-	-	1	1	-	3	3	1	1
CO4	3	3	3	-	2	-	-	-	2	-	-	3	3	-	2
CO5	3	3	3	-	2	-	-	-	-	2	-	3	3	2	-
CO6	3	3	3	-	-	-	-	-	-	3	-	3	3	-	1

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Study and calibration of a pitot tube.
2. Determination of Meta centric height.
3. Verification of conservation of energy principle for a given flow system using Bernoulli's Theorem.
4. Calibration of Rotameter.
5. Verification of Reynold's number for laminar flow and turbulent flow.
6. Determination of discharge of a given pipe flow using Venturi meter.
7. Determination of discharge of a given pipe flow using orifice meter.
8. Determination of friction factor for a given flow system.
9. Determination of minor losses for a given pipe line.

Total : 30 Hours

`

U19CETL307L **SURVEYING LABORATORY**

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- The knowledge and exposure of various surveying field techniques.
- The knowledge of mathematics in surveying field to calculate areas and volumes for different projects.
- Practical knowledge on calculation of an area, volume of an irregular and regular land surface using chains and tapes.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Apply theoretical considerations in field and other engineering projects.

CO2 : Measurement of an area by chain survey obtain the direction of a surveying line with a prismatic and surveyors compass.

CO3 : Acquire practical knowledge on handling basic survey instruments including Theodolite, Tacheometry, Total Station.

CO4 : Carryout Triangulation including general field marking for various engineering projects and Location of site etc.

CO5 : Collect data, write reports and able to perform required calculations to achieve the objective for different types of surveying for different Engineering projects.

CO6 : Calculate distance, gradient and different heights between two inaccessible points using total station.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	-	-	-	-	-	1	-	2	3	1	1
CO2	3	2	1	3	1	-	-	-	1	1	-	3	3	1	1
CO3	3	3	2	1	2	-	-	-	1	1	-	3	3	1	1
CO4	3	3	2	-	2	-	-	-	-	1	-	3	3	2	-
CO5	3	2	2	1	-	-	-	-	1	1	-	3	3	2	-
CO6	3	2	3	1	1	-	-	-	1	-	-	3	3	-	1

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Compass traversing – Measuring Bearing & arriving included angles.
2. Find the reduced level of points using Fly levelling.
3. Find the reduced level of points using Check levelling.
4. Measurement of horizontal angle by repetition method.
5. Measurement of horizontal angle by reiteration method.
6. Determination of Tacheometric Constants.

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7. Determination of heights and distance by Stadia Tacheometry.
8. Determination of the given area using total station.
9. Mark the column points in the field by using Total Station.

Total : 30 Hours

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U19CETL308L **CONSTRUCTION MATERIALS LABORATORY**

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- The understanding of the behaviour of construction materials.
- Skills for analysing experimental data and working in teams.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.

CO2 : Function on multi-disciplinary teams in the area of materials testing.

CO3 : Understand the properties of different building materials.

CO4 : Use the techniques, skills and modern engineering tools necessary for engineering.

CO5 : Communicate effectively the mechanical properties of materials.

CO6 : Conduct experiments that measures the physical properties of materials and assemblies.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	3	1	1	-	1	-	-	3	3	2	2
CO2	3	2	1	2	3	-	-	-	-	-	-	3	3	2	1
CO3	3	3	1	2	3	-	-	-	-	-	-	3	3	3	1
CO4	3	2	2	1	-	-	1	-	-	-	-	3	3	1	1
CO5	3	2	-	1	-	-	-	-	-	3	-	3	3	1	-
CO6	3	2	1	1	-	-	1	-	-	-	-	3	3	1	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Grading of M Sand – sieve analysis.
2. Grading of Coarse aggregates – sieve analysis.
3. Test for bulk density of fine aggregates.
4. Determination of impact value of Coarse aggregates.
5. Determination of Crushing value of Coarse aggregates.
6. Determination of Elongation index.
7. Determination of Flakiness index.
8. Grading of M Sand – sieve analysis.
9. Grading of Coarse aggregates – sieve analysis.

Total : 30 Hours

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U19CETL309L **ENGINEERING GEOLOGY LABORATORY**

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- Basics knowledge of geology that is required for constructing various Civil Engineering Structure, basic Geology, Geological Hazardous and Environmental Geology.
- Explain the importance of geophysical and geological studies of sites for tunnels, dams and reservoirs.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the basic principles of Engineering geology and correlate with experiments.
CO2 : Explain the physical properties of minerals and chemical properties of minerals.
CO3 : Summarize various methods of structural Geology.
CO4 : Analyse the internal geological processes.
CO5 : Explain the Earthquake techniques and seismograph.
CO6 : Identify and classify rock using basic geologic classification systems.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	-	-	-	-	-	-	3	2	-	-
CO2	3	1	2	2	1	-	-	-	-	-	-	3	2	-	-
CO3	3	2	1	3	-	-	-	-	-	-	-	3	3	-	-
CO4	3	1	-	-	-	-	-	-	-	-	2	3	2	-	-
CO5	3	1	-	-	1	-	-	-	-	-	-	3	2	-	-
CO6	3	-	-	-	1	-	-	-	-	-	-	3	2	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Physical Properties of Minerals.
2. Physical Properties of rocks.
3. Identification of minerals in hand specimen.
4. Identification of rocks in hand specimen.
5. Interpretation of Geological map.
6. Dip and Strike problems.
7. Identification of sedimentary rocks.
8. Identification of Metamorphic rocks.
9. Identification of Igneous rocks.

Total : 30 Hours

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U19CCLC301	CAREER ENHANCEMENT PROGRAM – I	L	T	P	C
		1	1	0	1

Course Objectives

This course aims to provide the students to,

- To develop active listening skills in various contexts.
- To develop the students‟ ability to use English accurately, appropriately and fluently in different social and professional situations.
- To enable students to gain a strong foundation by expanding their logical, numerical and reasoning skills.
- To ensure students develop ability to comprehend, work with, and apply general mathematical techniques and models to different situations.

Course Outcomes:

At the end of the course students will be able to

CO1 : Listen and comprehend technical and non-technical spoken experts critically and functionally.

CO2: Able to use English accurately, appropriately and fluently in different social and professional situations.

CO3 : Able to gain a strong foundation by expanding their logical, numerical and reasoning skills

CO4 : Ability to comprehend, work with, and apply general mathematical techniques and models to different situations.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	3	-	2	-	-	1
CO2	-	-	-	-	-	-	2	-	2	3	-	2	-	-	2
CO3	3	2	-	-	-	2	-	-	1	-	-	2	2	3	-
CO4	2	2	-	-	-	-	-	2	-	-	-	2	-	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I **4**

Applied Language Skills: Pronunciation – Homophones/ Homonyms / Homographs – Listening to Business conversation and answering MCQs.

Quants: Number Series – Sequence – Alphabet Series – Odd man out.

UNIT II **4**

Applied Language Skills: Telephone Etiquette – Understanding the tone – Listening to Telephone conversation and filling the forms.

Quants: Seating Arrangements – Linear, Circular, Square, Rectangular Arrangement

UNIT III **4**

Applied Language Skills: Idioms & Phrases – Phrasal Verbs – Listening to Self introductions / conversations – Understanding the structure of the speech.

Quants: Family Tree- Statement Problems on Blood Relations – Direction Problems – Left Right Movement – Clockwise – Anti-clockwise.

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UNIT IV **4**

Applied Language Skills: Listening to describing the products – Interpretation of Charts – Usage of discourse markers.

Quants: Logical Deduction – Introduction to Sets – Venn Diagrams – Logic based questions using Venn diagram – Rules for to solve syllogism questions – Statement and conclusion.

UNIT V **4**

Applied Language Skills: Strategies for presentation – Practice – Decision Making -Problem Solving – Taking up a Listening Test LAB.

Quants: Clocks and Calendars – Minute Spaces – Hour Hand and Minute Hand – Odd Days – Leap Year –Ordinary Year – Counting of Odd Days.

Total : 20 Hours

Text Books:

T1. GMAT – All the Verbal: 978-1-5062-4904-9, 2019, Manhattan Prep, Newyork.

T2. Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student's Book). Cambridge University Press, New Delhi: 2005.

T3. Aggarwal, R.S. "Quantitative Aptitude", Revised Edition 2016, Reprint 2018, S.Chand& Co Ltd., New Delhi.

T4. Pearson Publication, "A Complete Manual for the CAT", 2018

Reference Books:

R1. Carter, R., & McCarthy, M. (2006). Cambridge grammar of English: A comprehensive guide: spoken and written English grammar and usage. Cambridge University Press.

R2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.

R3. Dhaval Bathia, Vedic Mathematics, JAICO Publishing House, 29th Edition, Mumbai, 2014

Web Resources:

W1. https://learnenglish.britishcouncil.org/skills/listening

W2. https://ieltspolska.pl/wp-content/uploads/2020/05/Listening-paper-assets.pdf

W3. https://www.cambridgeenglish.org/learning-english/activities-forlearners/?skill=listening

W4. https://testbook.com/aptitude-practice

W5. https://www.indiabix.com/aptitude/questions-and-answers/

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SEMESTER – IV

		L	T	P	C
U19MATH428	**NUMERICAL METHODS FOR CIVIL ENGINEERING**	**3**	**0**	**0**	**3**

Course Objectives

- Engineering Mathematics is an essential tool for describing and analysing engineering process and systems. It enables precise representation and communication of knowledge. The objective of the course is to understand the procedures for solving numerically different kinds of problems occurring which are widely used in Civil Engineering.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Determine the solution of equations.
CO2 : Evaluate numerical techniques for solving the problems involving the Interpolation.
CO3 : Apply the numerical techniques of differentiation and integration for engineering problems.
CO4 : Solve the Initial value problems for ordinary differential equations using single step methods and multi step method.
CO5 : Solve the Boundary value problems in partial differential equations which occur in engineering problems.
CO6 : Describe and apply basic numerical methods for civil engineering problem solving.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	-	-	-	-	-	2	2	2	2
CO2	3	3	2	-	2	-	-	-	-	-	-	2	2	2	2
CO3	3	3	3	-	2	-	-	-	-	-	-	2	2	2	2
CO4	3	3	2	-	2	-	-	-	-	-	-	2	2	2	2
CO5	3	3	2	-	2	-	-	-	-	-	-	2	2	2	2
CO6	3	3	3	1	3	-	-	-	-	-	-	3	2	2	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I SOLUTION OF EQUATIONS 9

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton – Raphson method – Solution of linear system of equations – Gauss Jordan method – Iterative methods of Gauss Seidel – Applications of Solution of equations in Civil Engineering.

UNIT II INTERPOLATION AND APPROXIMATION 9

Interpolation with equal intervals – Newton's forward and backward difference formulae – Interpolation with unequal intervals – Lagrange's interpolation – Inverse interpolation – Divided differences – Newton's divided difference formula – Applications of Interpolation and Approximation in Civil Engineering.

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UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials – Newton's forward and backward with derivatives – Numerical integration using Trapezoidal – Simpson's rule – Evaluation of double integrals by Trapezoidal – Applications of Numerical differentiation and integration in Civil Engineering.

UNIT IV INTIAL VALUE PROBLEM FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods – Taylor's series method – Euler's method – Fourth order Runge – Kutta method – Multi step method – Milne's methods for solving first order equations – Applications of Initial value problems for ordinary differential equations in Civil Engineering.

UNIT V BOUNDARY VALUE PROBLEM IN PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional wave equation by explicit method – Applications of Boundary value problems in partial differential equations in Civil Engineering.

Total : 45 Hours

Text Books:

T1. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", khanna Publishers, 9th Edition, New Delhi, 2007.

T2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.

T3. H.A. Taha, "Operation Research", Prentice Hall of India, 2002.

Reference Books:

R1. Chapra. S.C., and Canale. R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007.

R2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.

R3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2007.

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U19CETL410T	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students to,

- Know the method of finding slope and deflection of beams and trusses.
- Estimate the load carrying capacity of columns.
- Asses the state of stress in three dimensions.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the deformation and strains under different load action and response in terms of force and moments.

CO2 : Apply the engineering principles to calculate the reactions, force and moments.

CO3 : Find the load carrying capacity of columns and stresses induced in columns and cylinders.

CO4 : Determine principal stresses and planes for an element in three-dimensional state of stress and study various theories of failure.

CO5 : Analyse the unsymmetrical sections and curved beams.

CO6 : Competence in problem identification, formulation and solution.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	3	-	-	-	2	-	2	3	1	-
CO2	3	3	2	2	-	2	-	-	-	2	-	2	3	1	1
CO3	3	3	2	2	1	2	-	-	-	2	-	1	3	1	-
CO4	3	3	2	1	-	-	-	-	-	1	-	1	3	2	-
CO5	3	3	2	1	1	-	-	-	-	1	-	3	3	-	1
CO6	3	3	2	1	1	2	-	-	-	2	-	3	3	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I ENERGY PRINCIPLES 9

Energy stored in elastic members – shear, flexure and traction – Castigliano's theorems – Maxwell's reciprocal theorem – Principle of virtual work – unit load method – Application of energy theorems for computing deflections in determinate beams, plane frames and plane trusses.

UNIT II INDETERMINATE BEAMS 9

Concept of Analysis – Propped cantilever and fixed beams – fixed end moments and reactions – sinking and rotation of supports – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

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UNIT III COLUMNS AND CYLINDERS 9

Euler's column theory – critical load for prismatic columns with different end conditions – Effective length – limitations – Rankine-Gordon formula – Eccentrically loaded columns – middle third rule – core of a section – Thin cylindrical and spherical shells – stresses and change in dimensions – Thick cylinders – Compound cylinders – shrinking on stresses.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9

Stress tensor at a point – Stress invariants – Determination of principal stresses and principal planes – Volumetric strain. Theories of failure: Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Total Strain energy theory – Maximum distortion energy theory – Application problems.

UNIT V ADVANCED TOPICS 9

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre – curved beams – Winkler Bach formula – stresses in hooks.

Total : 45 Hours

Text Books

T1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2015.

T2. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.

T3. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures" (SMTS) Vol – II, Laxmi Publishing Pvt Ltd, New Delhi 2017.

Reference Books

R1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003.

R2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing company, 2007.

R3. Singh. D.K., "Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2016.

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U19CETL411T	APPLIED HYDRAULIC ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

This course aims to provide the students to,

- Students to various hydraulic problems like open channel flow and hydraulic machines.
- Able to relate the relate theory and practise of problems in Hydraulic Engineering.
- Get exposure about the application of various hydraulic engineering in the field of studying various devices, equipment and Machinery.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Apply their knowledge of fluid mechanics in addressing problems in open channels.
CO2 : Able to identify an effective section for flow in different cross sections.
CO3 : Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
CO4 : Understand the principles, working and application of turbines.
CO5 : Understand the components, function and uses of different types of pumps.
CO6 : Give brief description on different types of flows and channels and hydraulic design principles of channels.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	2	-	2	3	1	1
CO2	3	3	3	2	-	-	1	-	-	2	-	2	3	1	1
CO3	3	3	2	-	-	-	-	-	-	2	-	2	3	1	1
CO4	3	3	-	-	1	-	-	-	-	2	-	2	3	1	1
CO5	3	3	-	2	1	-	-	-	-	2	-	2	3	1	1
CO6	3	3	3	1	-	-	1	-	-	2	-	2	3	1	1

(3 – High, 2 – Medium, 1 – Low)

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.

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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 : 45 Hours

Text Books:

T1. R K Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 2018.

T2. Subramanya. K, "Flow in open channels", Tata McGraw Hill, New Delhi, 2014.

T3. Modi P.N and Seth. S.M "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi, 2019.

Reference books:

R1. Subramanya. K., "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2013.

R2. Chandramouli P.N., "Applied Hydraulic Engineering", Yes Dee Publishing Pvt. Ltd., 2017.

R3. Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.

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U19CETL412T	CONSTRUCTION PRACTISES	L	T	P	C
		3	0	0	3

Course Objectives

This course aims to provide the students to,

- Make the student a thorough understanding of the basics of building components and its construction.
- Understand about various types of masonry and flooring.
- Gain knowledge of various types of sub structures construction techniques.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Know the basic principles involved in Building Construction.
CO2 : Understand the types of masonry.
CO3 : Identify the types of Roofs and floors used in construction.
CO4 : Understand the staircase and supporting structures used in construction.
CO5 : Know about the various sub structure construction techniques.
CO6 : Understand the property, use, advantage and disadvantage of different material used in construction.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	2	-	1	-	-	-	2	-	1	3	1	1
CO2	2	2	1	-	-	-	-	-	-	2	-	1	3	1	1
CO3	2	2	1	-	-	1	-	-	-	2	-	1	3	1	1
CO4	2	2	1	-	2	-	-	-	-	-	-	1	3	1	1
CO5	2	2	-	-	2	1	-	-	-	-	-	2	3	1	1
CO6	2	2	1	2		1	-	-	-	1	-	2	3	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I BASIC PRINCIPLES 9

Structural systems – Load Bearing Structure – Framed Structure – Load transfer mechanism. Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork – Building foundations – types of foundation – basements – need for basements – Material selection for basements.

UNIT II MASONRY 9

Masonry – Selection of suitable types of Masonry – Stone Masonry – Types of bonds – Brick Masonry – Types of bonds – Composite masonry – Concrete Masonry – Reinforced masonry – Hollow block Masonry – Types of walls – Types of Partition walls – acoustics and fire protection – Plastering – Types of mortars for plastering – methods of plastering – Special materials used in plastering – Defects in plastering.

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UNIT III FLOORS AND ROOFS 9

Floors – Types of floor – Components of Floor – Flooring Materials Mossaic, Marble, granite, Tile flooring, Cladding of tiles – Roofs – Requirement of good roofs – Types of Roofs – Flat roofs – Sloping roofs – Shell Roofs – Roof coverings – AC sheets – GI sheets – Fabrication and erection roof trusses. Lintels – Classification of lintels – Arches – Classification of arches. Dampness – Causes – methods of preventing Dampness – Methods of damp proofing – Construction joints – needs and materials used.

UNIT IV STAIRS AND SUPPORTING STRUCTURE 9

Staircase – Types of staircase – Types of doors and windows – Wooden and metallic door frames - Ventilators – Fixtures and fastening for doors and windows. Shoring – Types – Underpinning – Types – Scaffolding – Components – Types – Form work – Form work for columns, beam, stairs, and walls – Shuttering – de-shuttering forms – Slip forms – Components of Slip forms – Applications.

UNIT V SUBSTRUCTURE CONSTRUCTION 9

Techniques of Box jacking – Pipe Jacking – Under water construction of diaphragm walls and basement – Tunnelling 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.

Total : 45 Hours

Text Books:

T1. Arora and Bindra .S.P, “Text Book of Building Construction”, Dhanpatrai sons, New Delhi, 2018.

T2. Varghese .P.C, “Building Construction”, Prentice Hall India, 2017.

T3. Punmia B.K., Ashok Kumar Jain, Arun Kumar Jain, “Building Construction”, Laxmi Publications Pvt. Ltd., New Delhi, 2019.

Reference Books:

R1. Gurucharan Singh, “Building Construction and Materials”, Standard Book House, Delhi, 2014.

R3. Deodhar, S.V. “Construction Equipment and Job Planning”, Khanna Publishers, New Delhi.

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U19CETL413T	SOIL MECHANICS	L	T	P	C
		3	0	0	3

Course Objectives

This course aims to provide the students,

- The principles that govern the use and application of soil as an engineering material in civil engineering projects.
- Knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification.
- To Familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the formation and types of soils.

CO2 : Classify the soil and assess the engineering properties, based on index properties.

CO3 : Understand the Concepts of Permeability and Seepage in the soil.

CO4 : Know about the consolidation and Compaction test performed in field.

CO5 : Develop an understanding of the principles of effective stress in saturated soils, and its application to various soil condition and to know the shear strength of the soils.

CO6 : Understanding of the basic application of the concepts of the soil mechanics.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	-	-	-	-	2	3	-	1
CO2	3	2	2	3	1	-	1	-	-	-	-	2	3	2	-
CO3	3	2	2	3	1	-	1	-	-	-	-	2	3	2	-
CO4	3	2	2	-	1	-	-	-	-	-	-	2	3	2	2
CO5	3	3	2	-	-	-	-	-	-	-	-	2	3	1	-
CO6	3	3	2	1	3	-	2	-	-	-	-	2	3	2	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I SOIL AND CLASSIFICATION 9

Definition of soil and soil mechanics – Formation and composition of soil – types of soil – clay mineralogy structural arrangement of grains – Three phase system of soil and their relationships – Specific gravity, void ratio, porosity, saturation, Density – Field density – sand replacement and core cutter method.

UNIT II INDEX PROPERTIES 9

Classification of soil – Grain size analysis – Consistency of soils – Atterberg's limit – Liquid limit, Plastic limit and Shrinkage limit – Determination – plasticity index, liquidity index, consistency index, shrinkage ratio, flow index and toughness index – Classification of coarse grained and fine grained soil as per BIS.

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UNIT III PERMEABILITY AND SEEPAGE 9

Capillary Phenomena of soil – Permeability – Definition – Assumption – one dimensional flow through soil – Darcy's law – Limitations – Discharge velocity and seepage velocity – factors influencing the permeability of soil – permeability determination – lab and field methods. Seepage – Two – dimensional flow – Laplace's equation – Introduction to flow nets – uses of flow nets. Simple problems Sheet pile and wier.

UNIT IV COMPACTION AND CONSOLIDATION 9

Compaction – field and lab methods – Proctor's test – factors affecting the compaction – California Bearing Ratio (CBR) test – effect of compaction in soil properties – Settlement – Factors influencing settlement – components of settlement – Terzaghi's theory of one -dimensional consolidation – coefficient of consolidation – Determination - √t and log t methods.

UNIT V STRESS DISTRIBUTION AND SHEAR STRENGTH 9

Static pressure in soil – Effective stress concept in soil – effective and neutral stresses – stress distribution in homogenous and isotropic medium – Boussinesq and Westergrad's analysis – Point load, Uniformly distributed load, line load – rectangular load – pressure bulb – Newmark's chart – Introduction. Shear strength – shear strength of cohesive and cohesion less soils – Mohr coulomb's failure theory – Shear strength – Direct shear, Triaxial, unconfined shear strength – factors influencing the shear strength soil.

Total : 45 Hours

Text Books:

T1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2014.

T2. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2017.

T3. Gopal Ranjan. A, S R Rao, "Basic and Applied Soil Mechanics" New Age International Publication, 2016.

Reference Books:

R1. Purushothama Raj. P., "Soil Mechanics and Foundations Engineering", Pearson Education, 2013.

R2. Venkatramaiah. C., "Geotechnical Engineering", New Age International Pvt. Ltd., New Delhi, 2017.

R3. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2017.

R4. Palanikumar. M., "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited Delhi, 2013.

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U19CELC414	DRAFTING 2D AND 3D MODEL USING AUTO CAD	L	T	P	C
		1	0	2	2

Course Objectives:

This course aims to provide the students,

- To create a detailed engineering drawing (2D) and basic 3D models in AutoCAD software.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Gain knowledge on Auto CAD usage in Civil Engineering.
CO2 : Set layers and blocks for CAD diagram.
CO3 : Inquire knowledge on the types of Hatches and usage in building.
CO4 : Know various types of dimensioning usage in building plan
CO5 : Create 3D models of simple building.
CO6 : Develop a level of comfort and confidence with AutoCAD through hands on experience.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	-	-	-	-	-	-	3	3	2	3
CO2	3	2	-	-	-	-	-	-	-	-	-	2	3	2	3
CO3	3	2	1	-	-	-	-	-	-	-	-	-	3	2	3
CO4	3	2	1	-	-	-	-	-	-	-	-	-	3	2	3
CO5	3	3	3	-	-	-	-	-	-	-	-	2	3	2	3
CO6	3	3	3	-	-	-	-	-	-	-	-	-	3	3	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 6

Understanding the Interface - Navigate 2D Drawings – Draw Lines and Rectangle – Cancel, Erase, and Undo Use – Coordinate Systems – Draw Circles, Arcs, and Polygons -Use Fillet and Chamfer – Use Grid and Snap – Employ Ortho and Polar Tracking – Use PolarSnap – Select Running Object Snaps – Harness the From Snap – Apply Object Snap Tracking – Create Selection Sets – Move and Copy – Rotate and Scale – Work with Arrays – Trim and Extend – Lengthen and Stretch - Offset and Mirror - Edit with Grips – Draw and Edit – Curved Polylines -Draw Ellipses – Shape Splines – Blend Between Objects with Splines.

UNIT II VISIBILITY AND APPEARANCE, BLOCKS 6

Change Object Properties – Set the Current Layer – Alter the Layer Assignments of Objects - Control Layer Visibility – Apply Linetype – Assign Properties by Object or by Layer – Manage Layer Properties – Isolate Objects.

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UNIT III ORGANISING BLOCKS, HATCHES AND GRADIENTS **6**

Define Blocks – Insert Blocks – Edit Blocks – Redefine Blocks – Work with Groups – Specify Hatch Areas – Associate Hatches with Boundaries – Hatch with Patterns – Hatch with Gradients.

UNIT IV ANNOTATIONS, LAYOUT AND PLOTTING **6**

Creating and editing texts – Dimensioning – keeping in control with constraints – Printing & Plotting.

UNIT V MODELING IN 3D **6**

Work with Tiled Viewports – Navigate with the View Cube – Orbit in 3D – Use Cameras – Navigate with Steering Wheels – Create Surface Models – Edit Surface Models – Create Solid Models – Edit Solid Models – Smooth Mesh Models – Place & Adjust lights – Create rendering – Document models with drawings.

Total : 30 Hours

Reference Books:

R1. Scott Onstott, AutoCAD 2012 and AutoCAD LT 2012, John Wiley & Sons.

R2. Ellen Finkelstein and Lee Ambrosius, Mastering Autodesk AutoCAD 2012 and AutoCAD LT 2012 BIBLE, John Wiley & Sons.

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U19CCEX404 **ENGINEERING EXPLORATION – IV**

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide the students,

- To enable the students to design and build simple systems on their own.
- To help experiment with innovative ideas in design and team work.
- To create an engaging and challenging environment in the engineering lab.
- To inculcate ethics and sustainability perspectives and enable students to work in a team.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the role of an engineer as a problem solver.
CO2 : Apply multi-disciplinary principles and build systems using engineering design process.
CO3 : Use appropriate tools for designing and development of solutions.
CO4 : Analyse engineering solutions from ethical and sustainability perspectives.
CO5 : Use basics of engineering project management skills while doing projects.
CO6 : Communicate, Collaborate and work as a team

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	1	-	-	-	-	-	-	-	-	2	1	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO3	-	-	3	3	3	-	-	-	-	-	-	2	3	3	-
CO4	-	-	-	-	-	3	3	3	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	3	3	2	-	3	2
CO6	-	-	-	-	-	-	-	-	3	3	3	2	-	2	2

(3 – High, 2 – Medium, 1 – Low)

Contents:

S.No	Topics	No. of Hours
1.	Introduction to Engineering	3
2.	Platform based development	12
3.	Mechanism	9
4.	Requirements	3
5.	Design	
6.	Ethics	6
7.	Sustainability	

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8.	Project Management Principles	3
9.	Guided Projects	
10.	Final Projects	9

Guidelines:

1. Practical based learning carrying credits.
2. Multi-disciplinary / Multi focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students
5. The students have to display their model at the end of semester
6. The progress of the course is evaluated based on class performance and final demonstration of prototype

Total : 30 Hours

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U19CETL410L **STRENGTH OF MATERIALS LABORATROY**

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- The student exposure testing of different materials under the action of various forces and determination of their characteristics experimentally.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Have the required knowledge in the area of testing of materials and components of structural elements experimentally.

CO2 : Determine the hardness, impact strength and toughness to analyse the application of a specific materials for a given design requirements.

CO3 : Understand the bending of beam and able to analyse the bending stress.

CO4 : Understand how different components will fail under load with help of theories of failure for brittle and ductile materials

CO5 : Work in group.

CO6 : Document results in written reports.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	2
CO3	3	3	3	2	1	2	-	-	-	-	-	2	3	1	1
CO4	3	1	-	2	-	-	-	-	3	-	-	1	3	1	-
CO5	3	-	-	2	-	-	-	-	3	-	-	1	3	-	-
CO6	3	-	-	-	-	-	-	-	3	-	-	1	3	1	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Compression test on Spring.
2. Deflection test on spring.
3. Double Shear Test on Mild Steel rod.
4. Verification of reciprocal theorem of deflection using a simply supported beam.
5. Verification of moment area theorem for slopes and deflections of the beam.
6. Determine the elastic properties of beam.

Total : 30 Hours

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U19CETL411L	APPLIED HYDRAULIC ENGINEERING LABORATROY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- The students to develop knowledge on various Hydraulic Machines and its application in real life.
- Reinforcing the fundamentals of fluid mechanics and machinery by hands on experiment.
- Students to verify the principles studied in theory by performing the experiments in lab.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Determine the discharges from various types of wiers & Notches.
CO2 : Determine and draw the characteristics curve of pumps.
CO3 : Draw the characteristics curves of turbines.
CO4 : Understand the behaviour of various hydraulic machines.
CO5 : Work in group.
CO6 : Document results in written reports.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	2	-	-	-	-	3	3	3	2
CO2	3	3	3	3	-	-	2	-	-	-	-	3	3	2	2
CO3	3	3	3	2	-	2	2	-	-	-	-	2	3	1	1
CO4	3	3	3	-	-	-	1	-	-	-	-	3	3	2	-
CO5	-	-	-	-	-	-	-	-	-	2	-	1	1	-	-
CO6	-	-	-	-	-	-	-	-	-	3	-	1	1	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Flow through Rectangular Notch.
2. Flow through Triangular Notch.
3. Flow through Trapezoidal Notch.
4. Performance Characteristics of Single stage Centrifugal Pump.
5. Performance Characteristics of Multi stage Centrifugal Pump.
6. Performance Characteristics of Reciprocating Pump.
7. Performance Characteristics of Submersible Pump.
8. Characteristics of Pelton wheel turbine
9. Characteristics of Francis turbine.
10. Characteristics of Kaplan turbine.

Total : 30 Hours

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U19CETL412L CONSTRUCTION PRACTISES LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- The students to develop knowledge on various types of masonry bonds used in construction.
- Comprehend knowledge on qualities of cement, bricks and stones that to be used in the construction.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Analyse the quality of cement used in the construction.
CO2 : Mark the foundation on field.
CO3 : Develop a model of various brick masonry.
CO4 : Know the quality of bricks and stones that needs to be used in the field.
CO5 : Work as a team.
CO6 : Write and present a report.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	1	1	3	2	-	-	-	-	3	3	1	1
CO2	2	-	-	-	-	3	1	-	2	-	-	3	3	-	-
CO3	-	-	-	-	3	1	-	-	3	-	2	3	3	-	-
CO4	1	-	1	-	-	3	2	-	-	-	-	3	3	-	-
CO5	-	-	-	-	-	-	-	-	3	3	1	3	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	1	3	-	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Compression test on Cement Mortar cube.
2. Consistency Test on Cement.
3. Foundation marking in the field.
4. Compression test on Bricks.
5. Water Absorption test on Bricks.
6. Study of field test on Bricks – Quality.
7. Study of field test on Stones – Quality.
8. Model making for brick Masonry – English bond.
9. Model making for brick masonry – Flemish bond.
10. Model making for brick masonry – Rat trap bond.

Total : 30 Hours

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U19CETL413L **SOIL MECHANICS LABORATORY**

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- To develop skills to test the soils for their index and engineering properties and to characterise the soil based on their properties.
- Basic understanding about the engineering behaviour of soils.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Perform common soil tests to identify physical and mechanical properties of soils.
CO2 : Understand the basic application of the concepts of the soil mechanics.
CO3 : Classify the Coarse grained soils based on sieve analysis test & grain size distribution curve.
CO4 : Be familiar with soil mechanics tests and determines which test is needed in designing civil engineering projects and/or solving engineering problems.
CO5 : Apply the laboratory results to problem identification, quantification, and basic soil mechanics related design problem
CO6 : Demonstrate the ability to write clear technical lab reports.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	-	3	-	-	-	-	1	-	2	3	2	3
CO2	3	3	2	2	1	-	-	-	-	1	-	2	3	2	3
CO3	3	3	2	-	-	-	-	-	-	1	-	2	3	2	3
CO4	3	1	2	3	1	3	3	-	2	2	-	3	3	1	3
CO5	3	3	3	3	1	3	1	-	3	-	-	3	3	-	3
CO6	-	-	-	-	-	3	-	2	3	3	-	1	1	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments

1. Determination of Specific gravity of Soil.
2. Grain size distribution – Sieve analysis / Hydrometer analysis.
3. Determination Shrinkage limit and Differential free swell tests.
4. Permeability determination by constant head and falling head methods.
5. Direct shear test in cohesionless soil.
6. Unconfined compression test in cohesive soil.
7. Tri-axial compression test in cohesionless soil (Demonstration only).
8. One dimensional Consolidation of Soil (Demonstration Only).
9. California Bearing Ratio Test.

Total : 30 Hours

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U19CCLC402 CAREER ENHANCEMENT PROGRAM – II

L	T	P	C
1	1	0	1

Course Objectives:

This course aims,

- Develop the students' ability to participate in the conversation.
- Develop an ability to use a number of key functional exponents with confidence and accuracy.
- To enable students to learn to interpret given information correctly, determine which mathematical model best describes the data, and apply the model correctly.
- To improve students' analytical and data interpretation skills.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Able to participate in formal/informal conversations

CO2 : Speak in different contexts confidently and accurately.

CO3 : Ability to interpret the given information correctly, determine which mathematical model best describes the data, and apply the model correctly.

CO4 : Improve analytical and data interpretation skills.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	3	-	-	-	2	1	-	3	3	-	2	-	2
CO2	-	3	3	-	-	-	2	1	-	3	2	-	2	-	2
CO3	-	3	2	-	-	-	2	1	-	3	3	-	2	-	2
CO4	-	3	2	-	-	-	3	1	-	3	3	-	2	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I **4**

Applied Language Skills: Self Introduction – Attending Interviews – Greeting – Starting a conversation- Social Conversation Skills.

Quants: Analogy Pattern Recognition – Relating two objects – Problems on Number Analogy – Pattern completion.

UNIT II **4**

Applied Language Skills: Asking and Giving Information – Apologising and Excusing – Giving Instructions – Roleplays

Quants: Coding and Decoding Pattern Recognition – Coding and decoding by letter shifting- Coding Letters of a Word-Coding and decoding in fictitious language.

`

UNIT III **4**

Applied Language Skills: Agreeing and disagreeing – Inviting, accepting and declining invitations – Negotiating Skills – Persuasive Skills – Debate

Quants: Analytical Reasoning – Problems related to shapes – To find the missing numbers – Shape Construction – Cubes & Dices.

UNIT IV **4**

Applied Language Skills: Expressing likes and dislikes – Complimenting – Mock Interviews – GD

Quants: Cognitive Problems & Puzzles – Find the next Image- Mirror Image- Water Image – Logical Puzzle

UNIT V **4**

Applied Language Skills: Taking up certificate speaking test.

Quants: Vedic Mathematics and Sudoku- Addition- Subtraction- System of Multiplication- Squaring numbers- Cube roots – Square roots – Logic-based Sudoku

Total : 20 Hours

Text Book:

T1. Chris Anderson, TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations The New york Times Paperback, 2018.

T2. GMAT – All the Verbal: 978-1-5062-4904-9, 2019, Manhattan Prep, Newyork

T3. Aggarwal, R.S. "Quantitative Aptitude", Revised Edition 2016, Reprint 2018, S.Chand& Co Ltd., New Delhi.

T4. Analytical Reasoning by M.K Pandey.

Reference Book:

R1. Interact English Lab Manual for Undergraduate Students. Orient Black Swan: Hyderabad, 2016.

R2. Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press: Oxford, 2014.

R3. Arun Sharma "How to Prepare for Quantitative Aptitude for the CAT", McGraw Hill Education; 8th edition 2018.

R4. Arun Sharma, "How to Prepare for Logical Reasoning for the CAT", McGraw Hill Education; 8th edition 2018.

Web Resource:

W1. https://www.ted.com/talks

W2. https://www.toastmasters.org/

W3. https://www.edudose.com/reasoning/

W4. https://testbook.com/aptitude-practice/

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SEMESTER – V

		L	T	P	C
U19CETH501	**DESIGN OF REINFORCED CONCRETE ELEMENTS**	**3**	**1**	**0**	**4**

Course Objectives:

This course aims to provide the students,

- The fundamentals of reinforced concrete design and design philosophies.
- To understand the behaviour of reinforced concrete elements.
- To develop the skill for analysing and designing basic reinforced concrete members.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Develop basic understanding of reinforced concrete as a construction material.

CO2 : Acquire knowledge on various design methodologies for the design of RC elements.

CO3 : Analyse and design flanged beams by limit state method and singly reinforced beams.

CO4 : Design the columns for axial, Uniaxial and Biaxial loadings.

CO5 : Design various types of slabs and staircase by limit state method.

CO6 : Design footing by limit state method.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	2	-	-	3	-	2	3	3	2
CO2	3	3	3	2	2	-	2	-	-	3	-	2	3	3	2
CO3	3	3	3	2	2	-	2	-	-	3	-	2	3	3	2
CO4	3	3	3	2	2	-	2	-	-	3	-	2	3	3	2
CO5	3	3	3	2	2	-	2	-	-	3	-	2	3	3	2
CO6	3	3	3	2	-	-	-	-	-	3	-	2	3	3	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 9+3

Objective of structural design – Type of Loads on Structures and Load combinations – Code of practices and Specifications – Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC – Properties of Concrete and Reinforcing Steel – Analysis and Design of Singly reinforced Rectangular beams by working stress method – Limit State philosophy as detailed in IS code.

UNIT II DESIGN OF BEAMS 9+3

Analysis and design of singly and doubly reinforced rectangular beams by Limit State Method. Analysis and design of Flanged beams 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.

`

UNIT III DESIGN COLUMNS **9+3**

Types of columns – Axially Loaded columns – Design of short Rectangular Square and circular columns – Design of Slender columns – Design for Uniaxial and Biaxial bending using Column Curves

UNIT IV DESIGN OF SLABS AND STAIRCASE **9+3**

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 V DESIGN OF FOOTINGS **9+3**

Concepts of Proportioning footings and foundations based on soil properties – Design of wall footing – Design of axially and eccentrically loaded Square, Rectangular pad and sloped footings – Design of Combined Rectangular footing for two columns only.

Total : 60 Hours

Text Books:

T1. Varghese .P.C, "Limit State Design Of Reinforced Concrete", 2nd Edition, PHI Learning Pvt. Ltd., 2014.

T2. Krishnaraju. R, Pranesh. R.N, "Design of Reinforced concrete IS: 456- 2000", New age International Publication (P) Ltd., New Delhi, 2016.

T3. Unnikrishna Pillai.S and Deavadas Menon, "Reinforced Concrete Design," Tata MacGraw Hill Publishing Company Limited, Second Edition, New Delhi, 2013.

Reference Books:

R1. Gambhir. M.L, "Design of Reinforced Concrete Structures", Prentice Hall of India, Pvt. Ltd., New Delhi, 2008.

R2. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete", Laxmi Publication Pvt. Ltd., New Delhi, 2007.

R3. Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Roorkee, 1998.

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U19CETL516T	STRUCTURAL ANALYSIS – I	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- An Introduction to Structural Concepts, as well as an overview of specific techniques for analysing determinate and Indeterminate Structures.
- To understand the concept of indeterminacy, analyse beams and frames using matrix methods and moment distribution methods.
- To understand the analysis of indeterminate structures and adopt an appropriate structural analysis technique.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Formulate, analyse and calculate the mechanical behaviour of simple structures..
CO2 : Analyse continuous beams, pin-jointed indeterminate plane frames, and rigid plane frames by strain energy method.
CO3 : Analyse the continuous beams and rigid frames by slope defection method.
CO4 : Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
CO5 : Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using the matrix flexibility method.
CO6 : Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	2	-	2	3	2	2
CO2	3	3	2	2	-	1	-	-	-	2	-	2	3	2	2
CO3	3	3	2	-	-	-	-	-	-	2	-	2	3	2	2
CO4	3	3	2	-	-	1	-	-	-	2	-	2	3	2	2
CO5	3	3	2	1	-	2	-	-	-	1	-	2	3	2	2
CO6	3	3	2	1	-	2	-	-	-	1	-	2	3	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I STRAIN ENERGY METHOD 9

Determination of Static and Kinematic Indeterminacies – Analysis of continuous beams, plane frames, and indeterminate plane trusses by strain energy method (up to two degrees of redundancy).

UNIT II SLOPE DEFLECTION METHOD 9

Slope deflection equations – Equilibrium conditions – Analysis of continuous beams and rigid frames – Rigid frames with inclined members – Support settlements – symmetric frames with symmetric and skew – symmetric loadings.

`

UNIT III MOMENT DISTRIBUTION METHOD 9

Stiffness and carry over factors – Distribution and carryover of moments – Analysis of continuous Beams – Plane rigid frames with and without sway – Support settlement – symmetric frames with symmetric and skew-symmetric loadings.

UNIT IV FLEXIBILITY METHOD 9

Primary structures – Compatibility conditions – Formation flexibility matrices – Analysis of indeterminate pin – jointed plane frames, continuous beams, and rigid jointed plane frames by direct flexibility approach.

UNIT V STIFFNESS METHOD 9

Restrained structure – Formation of stiffness matrices – equilibrium condition – Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

Total : 45 Hours

Text Books:

T1. Bhavikatti, S.S,Structural Analysis,Vol.1&2, Vikas Publishing House Pvt. Ltd., New Delhi, 2014.

T2. Vazrani.V.N And Ratwani, M.M, Analysis of Structures, Vol. II, Khanna Publishers, 2015.

T3. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing House Pvt Ltd. New Delhi, 2014.

Reference Books:

R1. Rajasekaran. S, & G. Sankara subramanian., "Computational Structural Mechanics", PHI Learning Pvt. Ltd, 2015.

R2. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.

R3. Hibbeler, R.C, Structural Analysis, 7th Edition, Prentice Hall, 2012.

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U19CETH502	FOUNDATION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To learn the different techniques of site investigation, prepare soil report and to select a suitable foundation based on the type of soil.
- Analyse different types of shallow footings based on intensity of load and arrive at a suitable dimension.
- To understand the theory of earth pressure and its types to carry out stability analysis.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Perform soil investigation, prepare soil report, and select suitable type of foundation for the given soil conditions.

CO2 : Estimate bearing capacity of soil using various theories and by in-situ testing methods.

CO3 : Study the nature of the soil behaviour for different foundation.

CO4 : Design the overall dimensions of different types of foundations.

CO5 : Assess the behaviour of single pile and group of piles in different types of soils.

CO6 : Estimate the earth pressure behind retaining walls and to carry out stability analysis of retaining walls.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	-	3	-	3	3	3	1
CO2	-	3	3	-	-	2	-	-	-	2	-	3	3	3	1
CO3	2	3	3	-	-	2	-	-	-	2	-	2	3	3	1
CO4	-	3	3	-	-	2	-	-	-	-	-	2	3	3	1
CO5	3	3	3	-	-	-	-	-	-	-	-	2	3	3	1
CO6	3	3	2	-	-	-	-	-	-	2	-	2	3	3	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Data interpretation – Strength parameters – Bore log report and Selection of foundation.

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UNIT II BEARING CAPACITY AND SETTLEMENT 9

Introduction- Location and depth of foundation – Codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems – Bearing capacity from in-situ tests (plate load, SPT and SCPT) Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of settlement of foundations on granular and clay deposits – Total and 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 – Seismic force consideration – Codal provision (No structural design).

UNIT IV PILE FOUNDATION 9

Types of piles and their function – Factors influencing the selection of pile – Load carrying capacity of single pile in granular and cohesive soil – static formula – dynamic formula – Capacity from insitu tests – negative skin friction – uplift capacity – Group capacity by different methods (Feld's rule, Converse-Labarre formula and block failure criterion) – Settlement of pile groups – interpretation of pile load test – Under reamed piles.

UNIT V RETAINING WALLS 9

Plastic equilibrium in soils – active and passive states- Rankine's theory – cohesionless and cohesive soil – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann's Graphical method – pressure on the wall due to line load – Stability analysis of retaining walls – Use of geosynthetics in retaining wall.

Total : 45 Hours

Textbooks:

T1. Murthy, V.N.S., "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd, New Delhi – 2014.

T2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2017 (Reprint).

T3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition 2017.

Reference Books:

R1. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", Wiley eastern ltd, New Delhi, 2nd Edition 2014.

R2. Das, B.M, "Principles of Geotechnical Engineering", Thompson Brooks/ Coles Learning, Singapore, 5th Edition, 2002.

R3. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2014.

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U19CETL518T	HIGHWAY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Provide basic knowledge in transportation so that students can understand and be able to solve transportation related problems.
- To Design for highway mode of transportation with a focus on highway user's characteristics, geometric and pavement design, traffic engineering, and transportation planning.
- Acquire knowledge on Maintenance of highways as per IRC standards, specifications and methods.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Acquire knowledge on planning and aligning of the highway.
CO2 : Design and understand the various components of highways.
CO3 : Design flexible and rigid pavements.
CO4 : Gain knowledge on various materials available for construction of highways.
CO5 : Understand the concept of pavement system and maintenance of pavements.
CO6 : Have an experience in the implementation of Engineering concepts which are applied in field of Transportation Engineering.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	3	-	-	-	-	-	-	2	-	3	3	2	1
CO2	3	-	3	-	-	-	-	-	-	2	-	2	3	2	1
CO3	3	3	3	2	-	-	-	-	-	2	1	2	3	2	1
CO4	3	-	3	2	-	-	-	-	-	2	1	3	3	2	1
CO5	3	2	3	2	-	-	-	-	-	-	-	2	3	2	1
CO6	3	2	3	2	-	-	-	-	-	1	-	3	3	2	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I HIGHWAY PLANNING & ALIGNMENT 9

History of road development in India – Classification of highways – Institutions for Highway planning, design and implementation at different levels – factors influencing highway Alignment – Engineering surveys for alignment, objectives, conventional and modern methods.

UNIT II GEOMETRIC DESIGN 9

Importance of geometric design – design controls and criteria – cross section elements – pavement surface characteristics – camber – carriageway – kerbs – road margins – sight distance – stopping sight distance – overtaking sight distance – sight distance intersections – design of horizontal alignment – super elevation – transition curves – design of vertical alignment – gradients – vertical curves.

`

UNIT III HIGHWAY MATERIALS 9

Highway construction materials, properties, testing methods – CBR Test for subgrade – tests on aggregate & bitumen – Test on Bituminous mixes – Construction practice including modern materials and methods, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fibre, Plastic, Geo-Textiles, Geo-Membrane (problem not included) – Quality control measures – Highway drainage — Construction machineries.

UNIT IV DESING OF PAVEMENTS 9

Pavement components and their role – Design principles – Design practice for flexible and rigid Pavements (IRC methods only) – Embankments – Problems in Flexible pavement design.

UNIT V MAINTEANANCE AND OPERATION 9

Pavement distress in flexible and rigid pavements – Types of maintenance – Pavement Management Systems – Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements – Strengthening of pavements –Highway Project formulation.

Total : 45 Hours

Text Books:

T1. Highway Engineering by S.K. Khanna, C.E.G. Justo, A. Veeraragavan, 10th Edition, Nemchand and Bro., Roorkee, 2014.

T2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2014.

T3. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 8th edition Delhi, 2013.

Reference Books:

R1. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2013.

R2. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 8th edition Delhi, 2013.

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U19CETL519T	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- The foundations of many basic Engineering tools and concepts related to Concrete technology and Civil Engineering.
- To define and understand concepts related to Concrete technology which involves types and property of concrete and different adhesive materials and its vital use for safe, economic development for the buildings.
- To give an experience in the implementation of Special Concretes which are applied in the field of Civil Engineering.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Identify the requirements of cement, aggregates, and water for making concrete.
CO2 : Understand the effect of admixtures on properties of concrete.
CO3 : Acquire knowledge of concepts and procedure of mix design as per IS code.
CO4 : Apply design mix to produce concrete with adequate strength**.**
CO5 : Assess the properties of concrete at a fresh and hardened state.
CO6 : Know the application of special concretes.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
CO2	3	2	2	-	1	3	3	-	-	-	-	3	3	1	1
CO3	3	2	2	1	-	-	-	-	-	3	-	3	3	1	1
CO4	3	2	2	-	1	-	-	-	-	2	-	3	3	1	1
CO5	3	2	2	1	-	-	3	-	-	3	-	3	3	1	1
CO6	3	2	2	-	1	3	-	-	-	2	-	3	3	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I CONSTITUENT MATERIALS 9

Cement – Different types – Chemical composition and Properties – Hydration of cement – Tests on cement – IS Specifications – Aggregates – Classification – Mechanical properties and tests as per BIS – Grading requirements – Water – Quality of water for use in concrete.

UNIT II CHEMICAL AND MINERAL ADMIXTURE 9

Accelerators – Retarders – Plasticizers – Superplasticizers – Waterproofers – Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag, and Metakaoline – Effects on concrete properties.

`

UNIT III PROPORTIONING OF CONCRETE MIX 9

Principles of Mix Proportioning – Properties of concrete related to Mix Design – Physical properties of materials required for Mix Design – Design Mix and Nominal Mix – BIS Method of Mix Design – Mix Design Examples.

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE 9

Workability – Tests for the workability of concrete – Segregation and Bleeding – Determination of strength Properties of Hardened concrete – Compressive strength – split tensile strength – Flexural strength – Stress-strain curve for concrete – Modulus of elasticity – durability of concrete – water absorption – permeability – corrosion test – acid resistance.

UNIT V SPECIAL CONCRETE 9

Light weight concretes – foam concrete- self compacting concrete – vacuum concrete – High strength concrete – Fibre reinforced concrete – Ferrocement – Ready mix concrete – SIFCON – Shotcrete – Polymer concrete – High performance concrete – Geopolymer Concrete.

Total : 45 Hours

Textbooks:

T1. Shetty.M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2014.

T2. Santhakumar. A.R., "Concrete Technology", Oxford University Press India, 2013.

T3. Bhavikatti.S.S, "Concrete Technology", I.K.International Publishing House Pvt. Ltd., New Delhi, 2015.

Reference Books:

R1. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London, 1995.

R2. Gambhir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007.

R3. Kumar P Mehta., Paulo J M Monterio., "Concrete – Microstructure, Properties, and Materials", McGraw Hill Education (India) Private Limited, New Delhi, 2016.

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U19CCEX505 **ENGINEERING EXPLORATION – V**

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide the students,

- To enable the students to design and build simple systems on their own.
- To help experiment with innovative ideas in design and team work.
- To create an engaging and challenging environment in the engineering lab.
- To inculcate ethics and sustainability perspectives and enable students to work in a team.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the role of an engineer as a problem solver.
CO2 : Apply multi-disciplinary principles and build systems using engineering design process.
CO3 : Use appropriate tools for designing and development of solutions.
CO4 : Analyse engineering solutions from ethical and sustainability perspectives.
CO5 : Use basics of engineering project management skills while doing projects.
CO6 : Communicate, Collaborate and work as a team.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	1	-	-	-	-	-	-	-	-	2	1	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO3	-	-	3	3	3	-	-	-	-	-	-	2	3	3	-
CO4	-	-	-	-	-	3	3	3	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	3	3	2	-	3	2
CO6	-	-	-	-	-	-	-	-	3	3	3	2	-	2	2

(3 – High, 2 – Medium, 1 – Low)

Contents:

S.No	Topics	No. of Hours
1.	Introduction to Engineering	3
2.	Platform based development	12
3.	Mechanism	9
4.	Requirements	3
5.	Design	
6.	Ethics	6
7.	Sustainability	

`

8.	Project Management Principles	3
9.	Guided Projects	
10.	Final Projects	9

Guidelines:

1. Practical based learning carrying credits.
2. Multi-disciplinary / Multi focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students
5. The students have to display their model at the end of semester
6. The progress of the course is evaluated based on class performance and final demonstration of prototype

Total : 30 Hours

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U19CETL516L	STRUCTRUAL ANALYSIS LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- The students all the essentials to learn and use the STADD.Pro Software.
- How to design of RC structures using software Staad.pro.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Use to software STAAD.Pro.
CO2 : Students will be able to model (2D & 3D) buildings using software Staad.pro.
CO3 : Use the software to analyse the various types frames and beams.
CO4 : Design various types of frames and beams using software.
CO5 : Work with team effectively.
CO6 : Prepare and take final report of analyses and design.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	3	3	-	-	2	3	1	3	3	-	3
CO2	1	-	2	1	3	3	-	-	2	3	-	3	3	-	2
CO3	3	3	-	-	3	2	-	-	3	1	-	3	3	2	2
CO4	3	3	-	-	3	3	-	-	3	1	-	3	3	2	2
CO5	-	-	-	-	3	3	-	2	3	2	2	-	1	-	-
CO6	2	-	-	-	3	3	-	1	3	3	-	-	1	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Introduction STADD.Pro
2. Analysis and design of Simply supported beam.
3. Analysis and design of continuous beam.
4. Analysis of Single storey frame.
5. Analysis of Multi Storey Frame.
6. Design of Mutli Storey Frame.

Total : 30 Hours

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U19CETL518L **HIGHWAY ENGINEERING LABORATORY**

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- The students to learn the principals and procedures of testing of highway materials.
- The students on how to test and analyse the aggregates.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Recognise the knowledge about different physical properties of aggregates by performing different test on road aggregates

CO2 : Outline the various properties of bitumen material and mixes by performing various tests on it.

CO3 : Evaluate the strength of subgrade soil by CBR test.

CO4 : Analyse the various engineering properties of various highway materials by performing test.

CO5 : Work together as a team.

CO6 : Prepare a report and document the results obtained from the test.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	1	1	3	1	2	3	3	-	3	3	-	2
CO2	2	-	1	-	1	3	1	-	3	3	-	3	3	-	3
CO3	3	-	1	-	-	3	-	-	-	3	-	3	3	2	3
CO4	3	3	-	1	-	3	-	-	3	3	-	3	3	2	2
CO5	-	-	2	-	-	2	-	3	3	3	-	3	-	-	-
CO6	-	-	-	-	-	-	-	3	3	3	-	3	-	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments

1. Test on Coarse Aggregates – Specific Gravity.
2. Los Angeles Abrasion test.
3. Water absorption of Coarse Aggregates.
4. Specific gravity of Bitumen.
5. Bitumen Penetration test.
6. Bitumen viscosity test.
7. Bitumen Softening test.
8. Bitumen Ductility test.
9. Bitumen Density test.
10. Determination of Binder content.

Total : 30 Hours

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U19CETL519L CONCRETE TECHNOLOGY LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- The students to learn the principals and procedures of testing of concrete.
- The learner to design concrete mix as per IS codes.
- The learners can demonstrate tests on cement, aggregates and concrete.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Outline the importance of testing of cement and its properties.
CO2 : Have an practical knowledge regarding concrete testing equipment and their operation.
CO3 : Assess the concept of workability and testing of concrete.
CO4 : Design the concrete mix by using IS methods.
CO5 : Examine the properties of concrete in hardened state.
CO6 : Work as a team and prepare the reports based on lab results.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	1	1	3	1	2	3	3	-	3	3	-	2
CO2	2	-	1	-	1	3	1	-	3	3	-	3	3	-	3
CO3	3	-	1	-	-	3	-	-	-	3	-	3	3	2	3
CO4	3	3	-	1	-	3	-	-	3	3	-	3	3	2	2
CO5	-	-	2	-	-	2	-	3	3	3	-	3	-	-	-
CO6	-	-	-	-	-	-	-	3	3	3	-	3	-	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments

1. Concrete Mix design using IS 10262
2. Determination of fineness of the cement.
3. Determination of Initial and Final setting time of cement.
4. Slump Test.
5. Compaction factor test.
6. Vee bee consistometer test.
7. Flow table test.
8. Test for Compressive strength – Cubes.
9. Test for Flexural Strength – Cylinders.

Total : 30 Hours

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U19CEIV501	SURVEY CAMP	L	T	P	C
		0	0	0	2

Course objectives:

This course aims to provide the students,

- The students to get practical training in the field work.
- The camp must involve work on a large area of not less than 40 acres outside the campus (Survey camp should not be conducted inside the campus).
- At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Prepare topographical map and contour map on an area.
CO2 : Relate theoretical knowledge of surveying to resolve real field problem.
CO3 : To establish horizontal control and vertical control by traversing and triangulation.
CO4 : Learn to use total station.
CO5 : Locate the latitude and longitude of survey camp by GPS.
CO6 : Learn to work as team, ethics and prepare technical reports of surveying.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	3	3	-	2	3	2	-	3	3	2	3
CO2	3	-	1	1	3	3	-	1	-	3	-	3	3	3	-
CO3	3	-	-	-	3	3	-	-	3	2	-	3	3	3	1
CO4	-	-	-	-	3	3	-	-	2	-	-	3	3	3	3
CO5	1	-	-	-	3	2	-	-	-	-	-	3	3	-	1
CO6	-	-	-	-	-	-	-	3	3	3	1	3	1	-	-

(3 – High, 2 – Medium, 1 – Low)

Activities in Survey Camp:

1. Traverse – using Total station.

2. Contouring:

- Radial tachometric contouring – Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line.
- Block Level/ By squares of size at least 100 Meter x 100 Meter atleat 20 Meter interval.
- L.S & C.S – Road and canal alignment for a Length of not less than 1 Kilo Meter atleast L.S at Every 30M and C.S at every 90 M.

3. Offset of Buildings and Plotting the Location.

4. Use of GPS to determine latitude and longitude and locate the survey camp location.

5. Traversing using GPS.

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U19CCLC503	CAREER ENHANCEMENT PROGRAM – III	L	T	P	C
		1	1	0	1

Course Objectives:

This course aims,

- To develop making inferences and predictions based on comprehension of a text.
- To distinguish main ideas from supporting detail.
- To enhance problem-solving skills, to improve basic mathematical skills.
- To help the students who are preparing for any type of competitive examination.
- To draw conclusions and/or make decisions based on analysis and critique of quantitative information using proportional reasoning.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Infer and predict content based on comprehension of a text.
CO2: Understand and distinguish main idea(s) from supporting detail
CO3 : make decisions based on analysis and critique of quantitative information using proportional reasoning.
CO4 : Enhance the problem-solving skills.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	3	-	-	-	2	1	-	3	3	-	2	-	2
CO2	-	3	3	-	-	-	2	1	-	3	2	-	2	-	2
CO3	-	3	2	-	-	-	2	1	-	3	3	-	2	-	2
CO4	-	3	2	-	-	-	3	1	-	3	3	-	2	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I **4**

Applied Language Skills: Reading for main ideas – Making Inferences – Identifying the theme – Writing different types of paragraphs – Para jumbles. **Quants:** Number System – Lcm & HCF – Simplification – Surds & Indices – Cyclicity- Equations – Classification on Numbers – Power cycles and remainders – Concept of highest common factor – the concept of least common multiple – Divisibility Rule – Number of zeros in an expression – Problems on Surds and Indices – Concept of Unit digit – Simultaneous equations- Quadratic equations – In equation.

UNIT II **4**

Applied Language Skills: Email etiquette – Email writing – Dangling modifiers – Writing different types of essays. **Quants: Fundamentals of Algebra – Averages –** Variables – Algebraic expressions – Substitution & evaluating expressions – Writing algebraic expressions **–** Percentages – the concept of percentage values through additions – fraction to the percentage conversion table.

`

UNIT III **4**

Applied Language Skills: Resume and cover letter writing – Visumes – Practice – Preparation of Resumes for placements. **Quants:** Ratios and Proportion- comparison of ratios – proportions – relation among the quantities more than two – variation. – Partnership – Mixtures and Allegations – Problem on Ages – Definition – Allegation rule – mean value (cost price) of the mixture – Problems with ages and Problems related to ratios.

UNIT IV **4**

Applied Language Skills: Technical Reports – Structure of the report – Critical Reasoning – Employee motivation, Satisfaction and commitment – Work Ethics **Quants:** Problem on Ages – Profit & Loss – Discount – Simple Interest & Compound Interest – Data Interpretation.

UNIT V **4**

Applied Language Skills: Organisational Communication – Leadership skills – Stress management – Self Appraisal – Taking up a Reading test. **Quants**: Time, Speed & Distance – Problems on Trains – Boats & Streams – Data Sufficiency.

Total : 20 Hours

Text Book:

T1. R.S. Agarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning".

T2. Jeff Olsen, "The Slight Edge", Momentum Media, 2013.

T3. Aggarwal, R.S. "Quantitative Aptitude", Revised Edition 2016, Reprint 2018, S.Chand & Co Ltd., New Delhi.

T4. Sarvesh Kumar Verma, "Quantitative Aptitude & Quantum CAT" Arihant Publications.

Reference Book:

R1. Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

R2. Raman, Meenakshi, and Sangeetha Sharma, " Professional Communication" Oxford University Press: Oxford, 2014.

R3. Arun Sharma "How to Prepare for Quantitative Aptitude for the CAT ", McGraw Hill Education; Eighth edition 2018.

R4. Pearson Publication, "A Complete Manual for the CAT", 2018.

Web Resource:

W1. https://learnenglish.britishcouncil.org/general-english/magazine

W2. https://blog.lingoda.com/en/10-news-sites-to-practice-your-english-reading-skills

W3. https://testbook.com/aptitude-practice/

W4. http://www.allindiaexams.in/online-test/online-aptitude-test/all

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SEMESTER – VI

		L	T	P	C
U19CETL620T	**DESIGN OF STEEL STRUCTURES**	**3**	**1**	**0**	**4**

Course Objectives:

This course aims to provide the students,

- The theoretical and practical aspects of Design of Steel Structure along with the planning and design aspects.
- Will get a diverse knowledge of Design of Steel engineering practices applied to real life problems.
- Will gain an experience in the implementation of Design of Steel Structures on engineering concepts which are applied in field Structural Engineering.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand and design the common bolted and welded connections for steel structures.

CO2 : Design tension members and understand the concept of shear lag.

CO3 : Understand the design concept of axially loaded columns and column base connections.

CO4 : Understand specific problems related to the design of laterally restrained and unrestrained steel beams.

CO5 : Design of element in roof trusses, joints, etc. use of hand hooks in steel trusses design.

CO6 : Understand the design process of structural members, their connections, and application of built-up sections.

Course Articulation Matrix:

CO/PO MAPPING													**CO/PSO Mapping**		
CO s	**PROGRAMME OUTCOMES (Pos)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	2	-	-	1	-	-	3	-	2	3	1	1
CO2	3	3	2	2	-	-	1	-	-	3	1	2	3	1	1
CO3	3	3	2	2	-	-	-	-	-	3	-	2	3	1	1
CO4	3	3	2	2	-	-	-	-	-	3	1	-	3	1	1
CO5	3	3	-	2	-	-	1	-	-	3	1	1	3	1	1
CO6	3	3	2	-	2	-	1	-	-	3	-	1	3	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 9+3

Type of steel Structures – Properties of Indian standard rolled steel sections – limit state method of design – partial safety factor – general codal requirements. **Joints:** Bolted and welded connections – modes of failure of joints – permissible stresses for various types of bolts and welds – pin connections – lap and butt joints – truss joint – angle seat connections – stiffened and unstiffened seat connection – moment resistant connections –beam to beam connections – beam and column splices.

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UNIT II TENSION MEMBERS 9+3

Tension Members – Types of Tension members and sections – Behaviour of Tension Members – Slenderness ratio – Net area – Net effective sections for Plates, Angles, and Tee in tension – Concepts of Shear Lag – Design of plate and angle tension members – design of built-up tension Members – Connections in tension members – Use of lug angles – Design of tension splice.

UNIT III COMPRESSION MEMBERS 9+3

Types of compression members and sections – Behaviour and types of failures – Short and slender columns – Current code provisions for compression members – Column formula and column curves – Design of single section and compound Angles – Axially Loaded solid section Columns – Design of Built-up Laced and Battened type columns – Design of column bases – Plate and Gusseted bases for Axially loaded columns – Splices for columns.

UNIT IV DESIGN OF FLEXURAL MEMBERS 9+3

Types of steel Beam sections – Behaviour of Beams in flexure – Codal Provisions – Classification of cross sections – Flexural Strength and Lateral stability of Beams – Shear Strength -Web Buckling, Crippling and the deflection of Beams – Design of laterally supported Beams – Design of Plated beams with cover plates – Design of Laterally unsupported Beams.

UNIT V ROOF TRUSES 9+3

Types of roof trusses for different spans – Estimation of dead, live and wind loads – Design of purlins.

Total : 60 Hours

Textbooks:

T1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2015.

T2. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800 – 2007, IK International Publishing House Pvt. Ltd., 2017.

T3. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2019.

Reference Books:

R1. Sai Ram. K.S. "Design of Steel Structures " Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2nd Edition, 2015.

R2. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013.

R3. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013.

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U19CETH604	STRUCTURAL ANALYSIS – II	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Learn the method of drawing influence lines and its uses in various applications like beams and plane trusses.
- To analyse the arches, suspension bridges and space trusses.
- Also to learn Plastic analysis of beams and rigid frames.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Represent ILD for simply supported and overhanging beam to moving load.
CO2 : Identify the vertical reaction, horizontal trust, and a bending moment of two and three-hinged arches.
CO3 : Analyse the internal forces in cables and suspension bridges.
CO4 : Analyse the space structures by tension coefficient method.
CO5 : Understand the concept of Plastic analysis and the method of analysing beams and rigid frames.
CO6 : Enable the student get a feeling of how real-life structures behave.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (Pos)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	1	-	-	-	-	3	1	1	3	1	1
CO2	3	3	2	3	-	-	1	-	-	3	1	1	3	1	1
CO3	3	3	2	-	-	-	-	-	-	3	-	1	3	1	1
CO4	3	3	2	3	-	-	1	-	-	3	-	1	3	2	1
CO5	3	3	2	1	-	-	-	-	-	3	1	1	3	2	1
CO6	3	3	-	1	-	1	-	-	-	3	1	1	3	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I MOVING LOADS AND INFLUENCE LINE 9

Influence Lines: Introduction – Construction of ILD for shear force and bending moment at a section's determination of load positions for maximum shear force and bending moments for simply supported and overhanging beams with several point loads and UDL and determination of their values – Sketching of absolute maximum BMD.

UNIT II ARCHES 9

Arches as structural forms – Examples of arch structures – Types of arches – Analysis of three -hinged, two hinged, and fixed arches having parabolic and circular shapes – Settlement and temperature effects.

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UNIT III CABLES AND SUSPENSION BRIDGES 9

Components and their Functions – Analysis of cable under concentrated loads and UDL – Shape of the cable under self weight – Anchorage of suspension cables – Bending Moment and Shear Force in suspension bridges with three hinged stiffened girders – Max Bending Moment due to moving single concentrated load and UDL – Influence lines for Bending Moment and Shear Force – Analysis of suspension bridges with two hinged stiffening girders.

UNIT IV SPACE STRUCTURE 9

Analysis of Space trusses by tension coefficient method – Beams curved in plan Suspension cables – cables with two and three hinged stiffening girders.

UNIT V PLASTIC ANALYSIS 9

Plastic analysis of structures – Assumptions – Moment redistribution – Analysis of fixed and continuous beams and portal frames by mechanism method.

Total : 45 Hours

Textbooks:

T1. Bhavikatti.S.S, "Structural Analysis,Vol.1 & 2", Vikas Publishing House Pvt. Ltd, New Delhi 2021..

T2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", Laxmi, Publications,2017.

T3. Vazrani.V.N And Ratwani,M.M, "Analysis of Structures", Vol.II, Khanna Publishers,2015.

Reference Books:

R1. Gambhir.M.L, "Fundamentals of Structural Mechanics and Analysis", PHI Learning Pvt. Ltd.,2011.

R2. Negi.L.S and Jangid R.S., "Structural Analysis", Tata McGraw-Hill Publishers, 2004.

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U19CETL621T	WATER AND WASTE WATER ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- The principles and design of water treatment units and distribution system.
- The ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.
- To perform water characterization to study various water demand.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Plan and estimate public water supply system.

CO2 : Design the components of treatment plant.

CO3 : Design and evaluate water supply project alternatives on basis of chosen criteria.

CO4 : Estimate sewage generation and design sewer system including sewage pumping stations.

CO5 : Understand the characteristics and composition of sewage and perform basic design of the unit operations and processes that are used in sewage treatment.

CO6 : Recognise public health and environmental objectives related to water supply and wastewater disposal.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	-	-	-	2	-	-	-	-	2	3	1	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	3	1	1
CO3	3	3	1	2	-	-	-	-	-	-	-	2	3	1	1
CO4	3	3	1	2	-	-	3	-	-	-	-	2	3	1	-
CO5	2	2	1	2	-	-	1	-	-	-	-	-	2	1	1
CO6	2	3	-	-	-	-	3	-	-	-	-	-	2	-	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I PLANNING FOR WATER SUPPLY SYSTEM 9

Public water supply system – Planning – Objectives – Estimation of population forecasting and water demand – Sources of water and their characteristics – Surface and ground water – Water supply intake structures – types of pumps and its location- pipes and conduits for water. Pipe materials – transmission main lines – laying, jointing and testing of pipes.

UNIT II WATER TREATMENT 9

Objectives of unit operations and processes – Principles, functions and design of plain sedimentation tanks, sedimentation cum coagulation tanks and sand filters – disinfection – Operation and maintenance of water treatment plants. Principles and functions of aeration – Iron and manganese removal, Defluoridation and demineralization – water softening – desalination – Reverse Osmosis.

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UNIT III WATER DISTRIBUTION AND SUPPLY TO BUILDINGS 9

Service reservoirs –Network design – Analysis of distribution networks- Operation and maintenance – leak detection, methods. Principles of water supply in buildings – House service connection– Systems of plumbing and types of plumbing.

UNIT IV SEWER DESIGN 9

Sources of wastewater generation – Estimation of DWF & WWF –Hydraulics of flow in sewers – Design of sanitary and storm sewers – sewers appurtenances – Sewage plumbing system for buildings – Effluent standards – Reclamation and Reuse of sewage.

UNIT V TREATMENT OF SEWEAGE 9

Objectives of unit operations – physico chemical treatments – Design of Screens, Grit chambers – Primary Sedimentation tanks. Types of secondary Treatment – Design of Activated sludge process and Trickling filter – Design of Septic tank with effluent disposal arrangements. Basic concepts on Advanced sewage treatment methods: SBR, UASBR and Hybrid Reactors – Theory on Sludge digestion and disposal.

Total : 45 Hours

Textbooks:

T1. Garg, S.K., "Water supply Engineering", Khanna Publishers, 31st Edition, 2017.

T2. Garg, S.K., "Sewage Disposal and Air Pollution (Environmental Engineering II)", Khanna Publishers, 38th Edition 2017.

T3. Punmia, B.C., Jain, A.K., and Jain. A .K, Environmental Engineering, Vol. I & II, Laxmi Publications, 2010.

Reference Books:

R1. Duggal K.N., "Elements of Environmental Engineering" S.Chand and Co. Ltd., New Delhi, 2014.

R2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2010.

R3. Vazrani.V.N And Ratwani,M.M, "Analysis of Structures", Vol.II, Khanna Publishers,2015.

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U19CETH605	RAILWAY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To impart basic knowledge on various railways components and their functions.
- An introduction about Geometric design, points and crossings
- To know about track maintenance and development of railways.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the influence of railway transportations in the society.

CO2 : Understand the various component of railways and its uses.

CO3 : Geometric design elements of a railway track.

CO4 : Acquire knowledge on amenities used in railways.

CO5 : Gain knowledge on recent trends and developments in railways.

CO6 : Plan, supervise, develop and improve all railway operation, from exploration, construction and development.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	2	1	-	-	-	-	-	3	1	1
CO2	-	-	3	2	-	2	1	-	-	-	-	2	3	1	1
CO3	2	3	3	2	-	-	-	-	-	-	-	3	3	1	1
CO4	3	2	2	-	-	-	1	-	-	-	-	3	3	1	1
CO5	1	2	2	2	-	-	-	-	1	-	-	3	3	1	1
CO6	1	2	3	-	-	-	-	-	-	-	-	3	3	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO RAILWAY **9**

Role of railway in transportation – historical development of railways in India classification in Indian railways – technical terms used in railway engineering – the permanent way – subgrade and embankments – ballast – sleepers.

UNIT II COMPONENTS OF RAILWAY TRACK **9**

Rail – rail joints and welding of rails – track fittings and fastenings – coning of wheels – stresses in railway track – creep of rails – track alignment – surveying.

UNIT III GEOMETRIC DESIGN **9**

Necessity of geometric design of railway track – gradient and grade compensation speed of train – radius of curvature superelevation – curves – realignment of curves by string line method – widening of gauge on curves.

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UNIT IV AMENITIES OF RAILWAY TRACK 9

Points and crossing – track junctions – stations and yards – equipment in station yards – signaling and control systems – interlocking of signals – construction of track.

UNIT V MODERN TRENDS IN RAILWAYS 9

Track drainage – conventional maintenance of track – modern methods track maintenance – underground railways and tunnelling – safety in railways – modern development in railways.

Total : 45 Hours

Textbooks:

T1. Sathish Chandra and M.M. Agrawal., "Railway Engineering", Oxford University Press, 2nd Edition, 2013.

T2. Rangwala., "Railway Engineering", Charotar Publication, 27th Edition, 2017.

Reference Books:

R1. S.C. Saxena., "A Text Book on Railway Engineering", Danpat Rai Publication, 2013.

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U19CEPR601	DESIGN PROJECT	L	T	P	C
		0	0	4	2

Course Objectives:

This course aims to provide the students,

- 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.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Examine a given problem using process of engineering problem analysis.
CO2 : Collect data in different forms and to have visual analysis.
CO3 : Use software's for design and analysis of structures.
CO4: Design complex structures in civil engineering field.
CO5: Learn work as team with ethics.
CO6 : Prepare and present the report Infront of the audience.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	2	1	3	1	-	3	3	3	3
CO2	3	3	3	1	-	2	-	-	1	-	-	3	3	-	1
CO3	-	-	-	-	1	3	-	2	3	-	-	3	3	3	3
CO4	3	-	3	-	3	3	-	-	2	3	-	3	3	3	3
CO5	-	-	-	-	-	1	-	3	3	3	-	3	2	-	-
CO6	-	-	-	-	-	-	-	3	3	3	-	3	-	1	-

(3 – High, 2 – Medium, 1 – Low)

Evaluation procedure:

The method of evaluation will be as follows:

- Internal Marks **: 20 Marks.**
  (Decided by conducting 3 reviews by the guide)
- Evaluation of project report **: 30 Marks.**
  (Evaluated by the external examiner appointed by University)
- Viva voce examination **: 50 Marks.**
  (Evaluated by the Internal examiner appointed by the HoD, external examiner appointed by the university and Guide of the course – with equal weightage)

Total : 100 Marks

Total : 60 Hours

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U19CETL620L DESIGN OF STEEL STRUCTURES LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

This course aims to provide,

- The better understanding of various joints in steel structure and its components.

Course Outcomes:

At the end of the course students will be able to

CO1 : Acquire knowledge on Detailing of various steel structural elements.
CO2 : Utilize computer software for drafting detailing drawings.
CO3 : Design and draw a neat sketch about various joints.
CO4 : Design bolted and welded connections for tension and comp. members and beams.
CO5 : Design and draw a compression and tensile member with lacing an battening.
CO6 : Understand the professional practise and engineering ethics for a civil engineers.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	2	2	2	-	-	2	-	-	3	3	3	2
CO2	3	1	-	1	3	3	-	-	-	3	-	3	3	3	3
CO3	3	-	-	-	3	3	-	2	3	3	-	3	3	2	-
CO4	3	1	1	-	3	2	-	-	-	3	-	3	3	2	-
CO5	3	-	-	-	3	-	-	-	-	3	-	3	3	2	-
CO6	1	-	-	-	-	1	-	3	3	3	-	1	2	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments

1. Draw the layout of different types of rivet connections.
2. Draw the neat sketch of staggered joints and show the pitch, gauge and edge distance.
3. Draw the plan and elevation of slab base.
4. Draw the plan and elevation of Gusset base.
5. Draw the neat sketch of column made by channel section with necessary arrangement lacing and battening.
6. Draw the neat sketch of column made by angle section with necessary arrangement lacing and battening.

Total : 30 Hours

`

U19CETL621L	WATER AND WASTE WATER ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- The students on how the common environmental experiments relating to water and waste water quality are performed.
- To analyse the physical, chemical and biological characteristics of water and waste water.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Perform common experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problem.

CO2 : Understand and use the water and wastewater sampling procedures and sample preservations.

CO3 : Understand the impact of water and wastewater treatment on people and the environment.

CO4 : Select or construct appropriate treatment schemes to remove certain pollutants present in water or wastewater.

CO5 : Demonstrate the ability to write clear technical laboratorial reports.

CO6 : Understand and apply ethical issues associated with decision making and professional conduct in the laboratorial and field environment.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1	2	-	1	-	-	2	3	3	2
CO2	-	3	2	3	2	1	-	-	-	-	-	3	3	3	-
CO3	3	2	2	3	-	2	3	-	-	-	-	3	3	-	2
CO4	-	3	-	3	-	3	3	3	1	1	-	3	3	-	2
CO5	2	3	3	-	-	3	3	2	-	3	-	1	2	1	-
CO6	-	-	-	-	-	-	-	3	3	2	-	3	-	-	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Determination of Hardness.
2. Determination of Chlorides.
3. Determination of Optimum Coagulant dosage.
4. Determination of residual chlorine and available chlorine in bleaching powder.
5. Determination Dissolved Oxygen and BOD for the given sample.
6. Determination COD for the given sample.
7. Determination of suspended, settleable, volatile and fixed solids.
8. Determination of Ammonium Nitrogen in Waste water sample.

Total : 30 Hours

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U19CCLC604	CAREER ENHANCEMENT PROGRAM – IV (Common to all programmes)	L	T	P	C
		1	1	0	1

Course Objectives:

This course aims,

- To develop strategies to improve students' writing skills.
- To learn different types of documents used for business writing.
- To understand the relevance & need of quantitative methods for making business decisions.
- To demonstrate a sound knowledge of the fundamentals of statistics and statistical techniques.
- To apply quantitative methods to solve a variety of decision-making problems.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Participate in formal/informal conversations.
CO2: Speak in different contexts confidently and accurately
CO3 : Understand the relevance & need of quantitative methods for making business decisions.
CO4 : Solve real-time problems statistically.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	3	-	-	-	2	1	-	3	3	-	2	-	2
CO2	-	3	3	-	-	-	2	1	-	3	2	-	2	-	2
CO3	-	3	2	-	-	-	2	1	-	3	3	-	2	-	2
CO4	-	3	2	-	-	-	3	1	-	3	3	-	2	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I **4**

Applied Language Skills: Active Vocabulary – Writing Personal experiences – Process Description
Quants: Time & Work – Pipes & Cisterns – using fractions, percentages & negative work.

UNIT II **4**

Applied Language Skills: Writing notices, business letters, and reports (Minutes & Projects).
Quants: Permutation & Combination – Probability – arrangements – selections – chances.

UNIT III **4**

Applied Language Skills: Feasibility Report, Progressive Report – Evaluation report.
Quants: Geometry – Mensuration Concepts – Area & Volume – 2D & 3D.

UNIT IV **4**

Applied Language Skills: Book review- Article writing – Writing emails – Letter to the editor.
Quants: Trigonometry – Basic concepts – Heights & Distance and its applications.

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UNIT V **4**

Applied Language Skills: Taking up certificate tests in reading.

Quants: Sequence & Series – Progressions – AP, GP & HP – Data Interpretations – Data Sufficiency.

Total : 20 Hours

Text Book:

T1. Chris Anderson, TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations The New york Times Paperback, 2018

T2. Kerry Patterson, Joseph Grenny,and Ron Mcmillan, Crucial Conversations Tools for Talking When Stakes Are High, McGraw Education, 2017.

T3. R.S. Agarwal, "Quantitative Aptitude for Competitive Examinations".

T4. R.S. Agarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning".

Reference Book:

R1. Interact English Lab Manual for Undergraduate Students. Orient Black Swan: Hyderabad, 2016.

R2. Raman, Meenakshi, and Sangeetha Sharma, "Professional Communication" Oxford University Press: Oxford, 2014.

R3. Arun Sharma "How to Prepare for Quantitative Aptitude for the CAT", McGraw Hill Education 8th edition 2018.

R4. Pearson Publication, "A Complete Manual for the CAT", 2018.

Web Resource:

W1. https://www.ted.com/talks

W2. https://www.toastmasters.org/

W3. https://testbook.com/aptitude-practice/

W4. http://www.allindiaexams.in/online-test/online-aptitude-test/all

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SEMESTER – VII

		L	T	P	C
U19CETH706	**DESIGN OF PRESTRESSED CONCRETE ELEMENTS**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provide the students,

- Introduction and need for prestressing in a structure.
- The methods, types and advantages of prestressing to the students.
- Knowledge to design a prestressed concrete structural elements and systems.

Course Outcomes:

At the end of the course students will be able to

CO1 : Understand the basic properties of prestressed concrete constituents.

CO2 : Understand the behaviour of prestressed concrete members and able to analyse the prestressed concrete beams.

CO3 : Design the prestressed concrete members for flexure and shear as per the relevant design code (IS 1343).

CO4 : Analyse for deflection of prestressed concrete members and design the anchorage zone.

CO5 : Analyse and design of composite beams and continuous beams.

CO6 : Design of prestressed concrete structures – sleepers, Tanks, pipes and poles.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	1	-	-	-	-	-	-	-	2	3	2	2
CO2	3	2	2	-	-	-	-	-	-	2	-	3	3	2	2
CO3	3	3	-	3	-	-	1	-	-	3	-	3	3	2	2
CO4	3	3	-	-	-	-	1	-	-	3	-	3	3	2	2
CO5	3	3	2	2	-	-	1	-	-	-	-	3	3	2	2
CO6	3	3	3	2	-	-	-	-	-	3	-	3	3	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I **INTRODUCTION – THEORY AND BEHAVIOUR** **9**

Basic concepts – Advantages and disadvantages – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections – Losses of prestress – Estimation of crack width.

`

UNIT II **DESIGN FOR FLEXURE AND SHEAR** **9**

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections – Design of sections of Type I and Type II post-tensioned and pre tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

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 states. Determination of anchorage zone stresses in post-tensioned beams – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

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 **TENSION AND COMPRESSION MEMBERS** **9**

Role of prestressing in members subjected to Tensile forces and compressive forces – Design of tension and compression members – Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

Total : 45 Hours

Textbooks:

T1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012

T2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012

Reference Books:

R1. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002

R2. Dayaratnam.P, "Prestressed Concrete Structures", Oxford and IBH, 2013

R3. IS1343:1980, "Code of Practice for Prestressed Concrete", Bureau of Indian Standards, New Delhi, 2012

R4. IS 3370 – Part 4 (2008), "Indian standard Code of practice for concrete structures for the storage of liquid- Design tables, code of practice", bureau of Indian standards, New Delhi

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U19CETL722T	ESTIMATION COSTING AND VALUATION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Ability to estimate the quantities of items of work involved in buildings, water supply and sanitary works.
- Ability to do rate analysis, valuation of properties and preparation of reports for estimation of various items.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Compare different types of estimates, units of measurements & payments for different item of works in construction and illustrate a relationship to Bill of Quantities and Scheduled rates.
CO2 : Estimate the quantities for buildings.
CO3 : Rate Analysis for all Building works, canals, and Roads and Cost Estimate.
CO4 : Understand types of specifications, principles for report preparation, tender notices types.
CO5 : Gain knowledge on types of contracts.
CO6 : Evaluate valuation for building and land.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	3	2	2
CO2	3	3	3	-	-	1	-	-	-	2	-	2	3	2	2
CO3	3	3	3	-	-	1	-	-	-	2	-	3	3	2	2
CO4	3	3	3	-	-	1	-	-	-	3	-	3	3	2	2
CO5	3	3	3	-	-	-	-	-	-	-	-	2	3	2	2
CO6	3	3	3	-	-	-	-	-	-	3	-	2	3	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I QUANTITY ESTIMATION 9

Purpose of Estimation – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls – culverts.

UNIT II RATE ANALYSIS AND COSTING 9

Standard Data – Observed Data – Schedule of rates – Market rates – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads – Cost Estimates.

`

UNIT III SPECIFICATIONS, REPORTS AND TENDERS 9

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads – TTT Act 2000 – Tender notices – types – tender procedures – Drafting model tenders, E-tendering – Digital signature certificates – Encrypting – Decrypting – Reverse auctions.

UNIT IV CONTRACTS 9

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD /MORTH – Standard bidding documents – Construction contracts.

UNIT V VALUATION 9

Definitions – Various types of valuations – Valuation methods – Necessity – Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent – Mortgage – Lease.

Total : 45 Hours

Textbooks:

T1. Dutta.B.N "Estimating and Costing in Civil Engineering: Theory and Practice Including Specifications and Valuations" (2017).

T2. Rangalwala S C "Estimating, costing and valuation", Charotar Publishing House"2017 17th Edition 2017 (First Reprint) (Revised).

Reference Books:

R1. R.C.Kohli "A Textbook of Estimating ,Costing & Accounts (Civil)" S. Chand Publishing year, 2013.

R2. A.K. Upadhyay "Civil Estimating & Costing: Including Quality Surveying, Tendering and Valuation" 2013.

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U19CETH707	CONSTRUCTION PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Learning about planning of construction projects, scheduling procedures and techniques, quality control projects and use of project information as decision making tool.
- Extensive practise on developing construction project network diagram schedules using methods used in industries.

Course Outcomes:

At the end of the course students will be able to

CO1 : Understand basic concepts of construction planning.
CO2 : Schedule the construction activities.
CO3 : Know about the basics and importance of construction management and cash flow concepts.
CO4 : Concepts of resource planning and allocation and control.
CO5 : Understand the quality control and safety during construction.
CO6 : Create construction project schedules.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	-	-	-	2	1	2	1	3	3	3	2
CO2	3	1	2	2	-	-	-	-	1	2	1	3	3	3	2
CO3	3	1	1	-	-	-	-	2	-	-	3	3	3	3	2
CO4	2	-	2	-	-	-	-	-	-	-	3	3	3	2	2
CO5	2	3	-	1	-	1	-	-	-	-	3	3	3	2	2
CO6	2	3	2	-	-	-	-	2	-	2	3	3	3	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I CONSTRUCTION PLANNING **9**

Basic concepts in the development of construction plans – Choice of Technology and Construction method – Defining Work Tasks – Work breakdown structure – Definition – Precedence relationships among activities – Estimating Activity Durations – Estimating Resource Requirements for work activities – coding systems.

UNIT II PROJECT PLANNING AND SCHEDULING **9**

Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events. Bar chart planning – CPM – Example problem – Activity time estimate – Earliest event time – Latest allowable occurrence time – Start and finish time of activity – Float – Critical activity and Critical path – Problems. PERT – Introduction – Use of PERT – Time estimate – Frequency distribution – Mean, Variance and standard deviation – Probability distribution – Expected time problem – Example problems.

`

UNIT III CONSTRUCTION PROJECT FORMULATION 9

Introduction to Construction Management – Project Organization – Construction Economics – Economic Decision Making – Time value of money – cash flow diagrams – Evaluation Alternatives – Effect of Inflation on cash flow – Evaluation of Public Projects.

UNIT IV RESOURCE MANAGEMENT 9

Basic concepts of resource management – Class of labour – labour productivity – Classification construction equipment – selection of construction equipment – methods of calculating depreciation – replacement model – material management functions – inventory management – Project cost management.

UNIT V QUALITY CONTROL AND SAFETY MANAGEMENT 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.

Total : 45 Hours

Textbooks:

T1. Chitkara, K.K. "Construction Project Management Planning, Scheduling and Control", Tata McGraw Hill Publishing Co., New Delhi, 2009.

T2. Kumar Neeraj Jha, "Construction project management", Dorling Kindersley, New Delhi.2013.

T3. Sengupta. B, Guha .H, "Construction management and planning", Tata McGrawHill, New Delhi,2001.

Reference Books:

R1. Sharma .S.C, "Construction Engineering and management", Khanna Publishers,Delhi,2008.

R2. Srinath,L.S., "Pert and CPM Principles and Applications", Affiliated East West Press, 2001.

R3. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.

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U19CEPR702	PROJECT WORK PHASE – I	L	T	P	C
		0	0	4	2

Course Objectives:

This course aims to provide the students,

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination

Course Outcomes:

At the end of the course students will be able to

CO1 : Choose an appropriate topic of study.
CO2 : Clearly formulate & state the research problem.
CO3 : Compile literature review and frame hypothesis for research as applicable.
CO4 : Plan research design including sampling, observational, statistical and operational designs if any.
CO5 : Learn to work as a team with ethics.
CO6 : Create a report and technical presentation

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	2	-	2	2	-	3	3	3	3
CO2	3	3	3	3	2	3	1	-	2	1	-	2	3	3	-
CO3	2	2	1	3	2	-	-	-	3	-	-	3	3	-	-
CO4	2	3	-	-	3	3	2	-	2	-	1	3	3	-	3
CO5	-	-	-	-	-	-	-	3	-	-	2	3	2	-	-
CO6	-	-	-	-	1	-	-	3	-	-	2	3	-	-	-

Syllabus:

The students will work for two hours per week guided by a group of staff members. They will be asked to give a presentation on any topic of their choice related to Civil Engineering and to engage in discussion with the audience. A brief copy of their presentation also should be submitted. They will defend their presentation. Evaluation will be based on the technical presentation and the report and also on the interaction shown during the presentation.

Total : 60 Hours

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U19CETL722L	ESTIMATION AND QUANTITY SURVEYING LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives:

This course aims to provide,

- Summarize the basic principle and standard methods for working out quantities in estimating.
- Demonstrate the detailed estimate of buildings and workout rate analysis of the various items of work.
- Understand the material requirements as per specified norms and standards.

Course Outcomes:

At the end of the course students will be able to

CO1 : Understand the preparation of an Abstract Estimate and detailed estimate of building.

CO2 : Carryout the estimation and rate analysis of various components of building using MS Excel.

CO3 : Understand the material requirements, units, methods of estimation & applies the approximate method for building estimation.

CO4 : Prepare reports on various items of works.

CO5 : Use the techniques, skills, and modern engineering tools necessary for engineering practice.

CO6 : Possess the knowledge and skills for employability.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	-	-	-	2	1	2	1	3	3	3	2
CO2	3	1	2	2	-	-	-	-	1	2	1	3	3	3	2
CO3	3	1	1	-	-	-	-	2	-	-	3	3	3	3	2
CO4	-	-	-	1	3	3	-	2	-	3	-	3	3	1	-
CO5	2	-	-	-	3	3	-	-	-	2	-	3	3	-	-
CO6	2	-	-	-	-	3	-	3	-	2	3	3	3	1	-

(3 – High, 2 – Medium, 1 – Low)

List of Experiments:

1. Estimation of Building (Long wall and Short Wall).
2. Estimation of Building (Centerline method).
3. Analysis of Rate for Concrete Work.
4. Analysis of Rate for Brick Work.
5. Analysis of Rate for Plaster Work.
6. Estimation of Quantity of Reinforcement.
7. Estimation of building by Plinth Area method.

Total : 30 Hours

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U19CEIV702	INDUSTRIAL TRAINING	L	T	P	C
		0	0	0	0

Course Objectives:

This course aims to provide,

- The students in industry so as to have a first-hand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

Course Outcomes:

At the end of the course students will be able to

CO1 : Apply the theoretical concepts to solve industrial problems with teamwork and multi disciplinary approach.

CO2 : Demonstrate professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.

CO3 : Understand the impact of engineering solutions and industrial safety in a global and social context.

CO4 : Function on Multi-disciplinary teams and familiar with organizational behaviour and management.

CO5 : Interact with industrial personnel and follow engineering practices and discipline prescribed in industry.

CO6 : Describe use of advanced tools and techniques encountered during industrial training and visit.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (Pos)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	-	3	3	3	2	-	2	3	1	-
CO2	2	-	-	-	2	-	3	3	3	2	-	2	3	1	-
CO3	2	-	-	-	2	-	3	3	3	2	-	2	3	1	-
CO4	1	-	-	2	-	2	-	2	-	-	3	3	3	-	-
CO5	2	3	2	-	-	-	-	3	-	-	3	3	3	-	-
CO6	3	2	-	-	3	2	-		-	-	-	3	3	-	-

(3 – High, 2 – Medium, 1 – Low)

Evaluation Procedure:

This course is mandatory and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made.

The Method of evaluation will be follows:

- Continuous Assessment (Duration of Training, Report) – 80 marks
- End Semester (Presentation/Viva voce) – 20 marks.

Strategy:

Students have to undergo minimum of one-week practical training in Civil Engineering related organizations of their choice with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

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SEMESTER – VIII

		L	T	P	C
U19CEPR803	**PROJECT WORK PHASE – II**	**0**	**0**	**12**	**6**

Course Objectives:

This course aims to provide the students,

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyse and discuss the test results, and make conclusions.

Course Outcomes:

At the end of the course students will be able to

CO1 : Compile relevant data, interpret and analyse it and test the hypothesis where ever applicable.
CO2 : Plan, implement and execute the project.
CO3 : Analyse and solve the complex problems
CO4 : Arrive logical conclusions and propose suitable recommendations on the research problem.
CO5 : Create a logically coherent project report and will be able to defend his/her work in front of a panel of examiners.
CO6 : Write effective technical report and demonstrate through presentation.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (Pos)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	2	2	3	3	-	-	3	3	3	2
CO2	-	-	-	-	3	2	3	3	3	3	3	3	3	3	2
CO3	3	3	3	-	-	2	-	2	3	3	-	3	3	3	2
CO4	2	-	3	-	2	-	-	1	-	2	3	3	3	-	3
CO5	2	-	-	-	2	-	-	2	-	-	3	3	1	-	-
CO6	-	-	-	-	-	3	-	-	-	-	3	3	1	-	-

(3 – High, 2 – Medium, 1 – Low)

Syllabus:

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

Total : 180 Hours

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PROFESSIONAL ELECTIVE – I

		L	T	P	C
U19CEPE001	**TOTAL STATION AND GPS SURVEYING**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provide the students,

- The working principle of Total Station equipment and solve the surveying problems.
- Hand on training with total station providing the skills and applications necessary in the field of surveying.

Course Outcomes:

At the end of the course students will be able to

CO1 : Gain Knowledge on working principles of total station and GPS instruments.
CO2 : Apply the use of Total station and GPS surveying in the field.
CO3 : Know propagation of EMR through atmosphere and corrections for its effects.
CO4 : Understand the various satellite systems available and its application.
CO5 : Know how to process data and extract output in GPS.
CO6 : Various techniques available for surveying and mapping with total station and GPS.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (Pos)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	2	-	-	-	-	1	-	2	3	2	2
CO2	3	2	-	-	1	-	-	-	-	1	-	-	3	2	2
CO3	3	-	2	-	2	3	-	-	-	-	-	2	3	-	2
CO4	2	1	2	1	3	1	-	-	-	-	-	2	3	-	-
CO5	3	-	1	2	-	1	-	-	-	-	-	2	3	2	-
CO6	2	-	2	-	3	-	-	-	-	2	-	3	3	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES 9

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Classification – applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies-Refractive index (RI) – factors affecting RI – Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition – Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction -Total atmospheric correction- Use of temperature – pressure transducers.

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UNIT II ELECTRO-OPTICAL AND MICROWAVE SYSTEM 9

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments – Traversing and Trilateration-COGO functions, offsets and stake out-land survey applications.

UNIT III SATELLITE SYSTEM 9

Basic concepts of GPS – Historical perspective and development – applications – Geoid and Ellipsoid-satellite orbital motion – Keplerian motion – Kepler's Law – Perturbing forces – Geodetic satellite – Doppler effect – Positioning concept – GNSS, IRNSS and GAGAN – Different segments – space, control and user segments – satellite configuration – GPS signal structure – Orbit determination and representation – Anti Spoofing and Selective Availability – Task of control segment – GPS receivers.

UNIT IV GPS DATA PROCESSING 9

GPS observables – code and carrier phase observation – linear combination and derived observables – concept of parameter estimation – downloading the data RINEX Format – Differential data processing – software modules -solutions of cycle slips, ambiguities, Concepts of rapid, static methods with GPS – semi Kinematic and pure Kinematic methods -satellite geometry & accuracy measures – applications-long baseline processing- use of different softwares available in the market.

UNIT V HYDROGRAPHIC, MINE AND CADASTRAL SURVEYING 9

Reconnaissance – Route surveys for highways, railways and waterways – Hydrographic survey- Tides – MSL – Sounding methods – Three point problem – River surveys – Measurement of current and discharge – Mine surveying Equipment – Weisbach triangle – Tunnel alignment and setting out – Transfer of azimuth – Gyro Theodolite – Shafts and audits – Cadastral survey- Legal – Real – Taxcadastre – Land record system – Settlement procedure – deformation studies.

Total : 45 Hours

Textbooks:

T1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 1996

T2. Satheesh Gopi, rasathishkumar, N.madhu, **—** Advanced Surveying , Total Station GPS and Remote Sensing **—** Pearson education , 2007 isbn: 978-81317 00679

Reference Books:

R1. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

R2. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.

R3. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.

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U19CEPE002 **IRRIGATION ENGINEERING**

L	T	P	C
3	0	0	3

Course Objectives:

This course aims to provide the students,

- Exposure to different phases in irrigation practices and Planning and management of irrigation.
- They will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understanding of the necessity of irrigation, principles, its advantages and disadvantages.
CO2 : Have knowledge and skills on crop water requirements.
CO3 : Understand the methods and management of irrigation.
CO4 : Gain knowledge on types of Impounding structures.
CO5 : Understand methods of irrigation including canal irrigation.
CO6 : Get knowledge on water management on optimization of water use.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (Pos)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	3	-	1	1	-	-	-	-	2	2	1	2
CO2	2	-	-	1	-	1	2	-	-	-	-	2	2	1	2
CO3	2	1	-	3	-	1	1	-	-	-	-	3	2	1	1
CO4	1	-	-	3	-	2	3	-	-	-	-	3	3	1	1
CO5	-	2	2	-	-	2	3	-	-	-	-	3	3	1	1
CO6	2	-	2	-	-	-	3	-	-	-	-	3	3	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I CROP WATER REQUIREMENT **9**

Need and classification of irrigation- historical development and merits and demerits of irrigation-types of crops-crop season-duty, delta and base period- consumptive use of crops- estimation of Evapotranspiration using experimental and theoretical methods

UNIT II IRRIGATION METHODS **9**

Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation – design of drip and sprinkler irrigation – ridge and furrow irrigation-Irrigation scheduling – Water distribution system- Irrigation efficiencies.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES **9**

Types of Impounding structures – Gravity dam – Forces on a dam -Design of Gravity dams; Earth dams, Arch dams- Diversion Head works – Weirs and Barrages.

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UNIT IV CANAL IRRIGATION 9

Canal regulations – direct sluice – Canal drop – Cross drainage works-Canal outlets – Design of prismatic canal-canal alignments-Canal lining – Kennedy's and Lacey's Regime theory-Design of unlined canal.

UNIT V WATER MANAGEMENT IN IRRIGATION 9

Modernization techniques – Rehabilitation – Optimization of water use Minimizing water losses – On form development works – Participatory irrigation management – Water resources associations – Changing paradigms in water management – Performance evaluation – Economic aspects of irrigation.

Total : 45 Hours

Textbooks

T1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.

T2. Punmia B.C., et. Al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009

T3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009

Reference Books

R1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005

R2. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000

R3. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw-Hill Inc., New Delhi, 1997.

R4. Sharma R.K.. "Irrigation Engineering", S.Chand & Co. 2007.

R5. Michael A.M., "Irrigation Theory and Practice", 2nd Edition, Vikas Publishing House Pvt. Ltd., Noida, Up, 2008.

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U19CEPE003	URBAN PLANNING AND DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- The knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Describe basic issues in urban planning.

CO2 : Formulate plans for urban and rural development.

CO3 : Plan and analyse socio economic aspects of urban and rural planning.

CO4 : Design of urban development projects.

CO5 : Manage urban development projects.

CO6 : Design infrastructure delivery systems with a focus on the policy makers, developers and users.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (Pos)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	-	-	-	1	-	3	1	-
CO2	1	-	2	-	2	1	1	-	1	1	-	-	3	1	2
CO3	-	1	2	-	3	1	2	-	-	-	-	-	3	1	-
CO4	2	1	2	2	2	1	1	-	1	1	-	1	3	1	-
CO5	1	-	2	1	-	1	1	-	-	-	-	-	3	1	-
CO6	1	-	-	-	3	-	-	-	-	-	-	3	-	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I BASIC ISSUES 8

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri – urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

UNIT II PLANNING PROCESS 8

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 10

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights, Special Economic Zones- Development of small town and smart cities-case studies.

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UNIT IV **PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS** **9**

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT V **LEGISLATION, DEVELOPMENTAND MANAGEMENT OF URBAN SYSTEM** **10**

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

Total : 45 Hours

Textbooks:

T1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002

T2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978

T3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001

T4. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986.

Reference Books:

R1. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai

R2. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005.

R3. CMDA, Second Master Plan for Chennai, Chennai 2008.

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U19CEPE004	HUMAN RIGHTS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- About various aspects of human rights.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Identify and evaluate the historical, philosophical, political and cultural developments establishing human rights.

CO2 : Understand the historical growth and evolution of human rights.

CO3 : Explore global human rights institutions, law, and processes.

CO4 : Understand the importance of the Human Rights Act in India.

CO5 : Reflectively evaluate the effectiveness of human rights practice on local, national or international humanitarian efforts.

CO6 : Know the values such as transparency, impartiality, clarity, reliance and the importance of sound reasoning and empirical inference.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	-	1	-	-	-	-	2	1	-
CO2	2	2	1	3	-	-	-	3	-	-	-	2	2	1	-
CO3	1	-	1	2	-	2	-	3	-	-	-	-	1	1	-
CO4	2	1	-	2	1	3	-	2	-	-	-	2	1	1	-
CO5	2	1	1	-	1		-	1	-	-	-	1	1	1	-
CO6	-	-	-	-	-	3	-	3	-	-	-	-	1	1	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I HUMAN RIGHTS ORIGIN 9

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II EVOLUTION OF HUMAN RIGHTS 9

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III THEORIES AND LAWS 9

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance

UNIT IV HUMAN RIGHTS IN INDIA 9

Human Rights in India – Constitutional Provisions / Guarantees.

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UNIT V HUMAN RIGHTS FOR DISADVANTAGED PEOPLE 9

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

Total : 45 Hours

Reference Books

R1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.

R2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.

R3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi

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U19CEPE005	REMOTE SENSING AND GIS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Introduction about the principles and basic concepts of remote sensing and GIS.
- Introduction about remote sensing systems, data products and analysis.
- Introduction about the spital data models, analysis and presentation techniques.
- The applications of Remote sensing and GIS in agriculture, soil and water resources.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Analyse the principles and components of photogrammetry and remote sensing.
CO2 : Gain knowledge on various types of sensors and platforms for satellites.
CO3 : Process of data acquisition of satellite images and their characteristics.
CO4 : Analyse an image visually and digitally with digital image processing techniques.
CO5 : Explain the concepts and fundamentals of GIS.
CO6 : Apply the knowledge of remote sensing and GIS in different civil engineering field.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	2	3	-	-	-	-	-	-	3	2	2	-
CO2	3	2	-	2	3	-	-	-	-	2	-	3	2	2	1
CO3	3	-	1	3	3	2	1	-	-	-	-	3	2	2	-
CO4	3	2	-	3	3	-	2	-	-	-	-	3	2	2	1
CO5	3	-	-	1	3	-	-	-	-	2	-	3	2	2	1
CO6	3	3	1	3	3	2	2	-	-	3	-	3	2	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO REMOTE SENSING 9

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan- Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts –typical spectral reflective characteristics of water, vegetation and soil

UNIT II PLATFORMS AND SENSORS 9

Types of platforms – orbit types, Sun- synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and space borne TIR and microwave sensors.

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UNIT III IMAGE INTERPRETATION AND ANALYSIS 9

Types of Data Products – types of image interpretation- basic elements of image interpretation- visual interpretation keys – Digital image processing – Pre-processing – image enhancement techniques – multispectral image classification – supervised and unsupervised.

UNIT IV CONCEPT OF GIS 9

Introduction – Maps- Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS software – data type – Spatial and non-spatial (attribute) data – measurement scales- Data base Management Systems (DBMS).

UNIT V DATA ANALYSIS 9

Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data analysis – Application of GIS in highway alignment studies, Environmental and water resources – land Information system.

Total : 45 Hours

Text Books:

T1. Anji Reddy. M, Remote Sensing and Geographical Information Systems, BS Publications, Hyderabad, 2001

T2. Lillesand, T. M., and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2000.

Reference Books:

R1. Bettinger, P., and Michael, G.W., "Geographical Information System: Applications in Forestry and Natural Resources Management," Tata McGraw–Hill Higher Education, New Delhi, 2003.

R2. Ian Heywood., "An Introduction to GIS", Pearson Education, New Delhi, 2001.

R3. Jeffery Star and John Estes, "Geographical Information System – An Introduction," Prentice Hall India Pvt. Ltd., New Delhi, 1998.

R4. Patel A.N & Surendra Singh, "Remote sensing principles & applications", Scientific Publishers, Jodhpur 1992.

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PROFESSIONAL ELECTIVE – II

		L	T	P	C
U19CEPE006	**PREFABRICTAED STRCUTURES**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provide the students,

- Knowledge to students on modular construction, industrialised construction and design of prefabricated elements and construction methods.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Knowledge about design principles, layout of factory and stages of loading in precast construction.
CO2 : Acquire knowledge about panel systems, slabs, connections used in precast construction and they will be in a position to design the elements.
CO3 : Acquire knowledge about types of floor systems, stairs and roofs used in precast construction.
CO4 : Design various types of walls used in precast construction, sealants, design of joints.
CO5 : Design the components of building for abnormal loadings.
CO6 : Acquire knowledge about components in industrial building.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	2	3	-	3	1	-	1	3	2	-
CO2	3	2	3	-	-	2	-	-	-	2	-	2	3	2	1
CO3	3	2	3	-	-	-	-	-	-	2	-	2	3	2	2
CO4	3	2	3	-	3	-	3	-	2	3	-	3	3	2	2
CO5	3	2	3	-	3	-	3	-	2	3	-	3	3	2	-
CO6	3	3	2	-	-	3	2	-	-	1	-	2	3	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 9

Need for prefabrication – Principles of prefabrication – Modular coordination – Standardization – 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.

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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 : 45 Hours

Textbooks:

T1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991.

T2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage", Applied Science Publishers , London And New Jersey, 1982.

T3. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2011.

Reference Books:

R1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH,1976.

R2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.

R3. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

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U19CEPE007	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Various problems associated with soil deposits and methods to evaluate them.
- Different techniques will be taught to them to improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Gain knowledge on methods and selection of ground improvement techniques.
CO2 : Comprehend dewatering techniques and design for simple cases.
CO3 : Get knowledge on insitu treatment of cohesionless and cohesive soils.
CO4 : Comprehend the concept of earth reinforcement and design of reinforced earth.
CO5 : Explain the various grouting techniques and its application for improving loadbearing of beneath soils.
CO6 : Identify the purpose of ground improvement techniques to obtain the suitable construction site for long lasting structures.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	-	1	-	-	-	-	-	2	3	1	-
CO2	3	2	3	2	-	1	-	-	-	-	-	2	3	1	1
CO3	3	2	-	3	-	-	-	-	-	-	-	2	3	-	-
CO4	3	2	3	3	-	-	2	-	-	-	-	3	3	2	-
CO5	3	-	2	-	-	-	2	-	-	2	-	3	3	2	-
CO6	3	3	3	3	-	2	-	-	-	-	-	2	3	-	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 9

Role of ground improvement in foundation engineering – Methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

UNIT II DEWATERING 9

Dewatering Techniques – Well points – Vacuum and electroosmotic methods – Seepage analysis for two-dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.

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UNIT III **INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS** **9**

Insitu densification of cohesionless soils – Shallow as deep compaction – Dynamic compaction – Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils – Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime Piles – Installation techniques – Simple design – Relative merits of above methods and their limitations.

UNIT IV **EARTH REINFORCEMENT** **9**

Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design – Applications of reinforced earth – Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

UNIT V **GROUTING TECHNIQUES** **9**

Types of grouts – Grouting equipment's and machinery – Injection methods – Grout monitoring – Stabilization with cement, lime and chemicals – Stabilization of expansive soil.

Total : 45 Hours

Textbooks:

T1. Purushothama Raj. P, "Ground Improvement Techniques", Lakshmi Publications, 2nd Edition, 2016.

T2. Koerner, R.M. "Construction and Geotechnical Methods in Foundation Engineering", McGraw Hill, 1994.

T3. Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas Publishing House, First Edition, 2012.

T4. Mittal.S, "An Introduction to Ground Improvement Engineering", Medtech Publisher, First Edition, 2013.

Reference Books:

R1. Moseley, M.P., "Ground Improvement" Blockie Academic and Professional, 1992.

R2. Moseley, M.P and Kirsch. K., 'Ground Improvement", Spon Press, Taylor and Francis Group, London, 2nd Edition, 2004.

R3. Jones C.J.F.P. "Earth Reinforcement and Soil Structure", Thomas Telford Publishing, 1996.

R4. IS Code 9759 : 1981 (Reaffirmed 1998) "Guidelines for Dewatering During Construction", Bureau of Indian Standards, New Delhi.

R5. IS Code 15284 (Part 1): 2003 "Design and Construction for Ground Improvement – Guidelines" (Stone Column), Bureau of Indian Standards, New Delhi.

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U19CEPE008	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Various problems associated with soil deposits and methods to evaluate them.
- Different techniques will be taught to them to improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the foundations of hazards, disasters and associated natural/social phenomena.
CO2 : Familiarity with disaster management theory (cycle, phases) and Methods of community involvement as an essential part of successful DRR.
CO3 : Apply knowledge about existing global frameworks and existing agreements.
CO4 : Understand consequences and inter relationship between development and disasters.
CO5 : Draw the hazard and vulnerability profile of India, Scenarios in the Indian context**.**
CO6 : Develop the strengths and weaknesses of disaster management approaches.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	1	3	3	-	-	1	-	2	3	1	-
CO2	-	2	1	1	2	2	3	-	3	-	-	2	2	-	2
CO3	-	3	2	1	-	3	1	-	3	-	-	2	2	1	2
CO4	3	3	-	1	3	3	2	-	-	-	-	2	3	1	-
CO5	-	3	2	1	3	3	2	-	-	3	-	2	3	-	-
CO6	3	3	2	-	1	3	2	-	-	-	-	-	2	-	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc – Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability – Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- non-structural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level – State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.

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UNIT III **INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT** **9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV **DISASTER RISK MANAGEMENT IN INDIA** **9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy – Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V **DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS** **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

Total : 45 Hours

Textbooks:

T1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010.

T2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012.

T3. Gupta Anil K, Sreeja S. Nair, “Environmental Knowledge for Disaster Risk Management”, NIDM, New Delhi, 2011

T4. Kapur Anu, “Vulnerable India: A Geographical Study of Disasters”, IIAS and Sage Publishers, New Delhi, 2010.

Reference Books:

R1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

R2. Government of India, National Disaster Management Policy,2009.

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U19CEPE009	MUNICIPAL SOLID WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.

CO2 : Compute the quantities of waste generated.

CO3 : Apply Reduction, reuse and recycling of waste.

CO4 : Plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.

CO5 : Knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context**.**

CO6 : Design and operation of sanitary landfill and other various methods of disposal.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	2	-	3	3	-	-	1	-	-	3	1	-
CO2	3	2	3	1	-	3	1	-	-	2	-	-	3	1	2
CO3	3	2	1	-	-	3	3	-	-	-	-	3	3	1	2
CO4	3	3	3	3	3	3	3	-	-	-	-	3	3	2	-
CO5	2	-	2	-	-	3	2	-	-	-	-	-	3	2	-
CO6	3	2	2	2	-	3	1	-	-	3	-	3	3	2	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I SOURCES AND CHARACTERISTICS 9

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes – factors affecting waste generation rate and characteristics – Elements of integrated solid waste management – Requirements and salient features of Solid waste management rules (2016) –- Role of public and NGO‟s- Public Private participation – Elements of Municipal Solid Waste Management Plan.

UNIT II SOURCE REDUCTION, WASTE STORAGE AND RECYCLING 9

Waste Management Hierarchy – Reduction, Reuse and Recycling – source reduction of waste – On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – case studies under Indian conditions – Recycling of Plastics and Construction/Demolition wastes.

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UNIT III COLLECTION AND TRANSFER OF WASTES 9

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance; options under Indian conditions – Field problems- solving.

UNIT IV PROCESSING OF WASTES 9

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and bio methanation; Thermal processing options – case studies under Indian conditions.

UNIT V WASTE 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 : 45 Hours

Textbooks:

T1. William A. Worrell, P. Aarne Vesilind, "Solid Waste Engineering", Cengage Learning, 2012.

T2. John Pitchel (2014), "Waste Management Practices-Municipal, Hazardous and industrial", CRC Press, Taylor and Francis, New York.

Reference Books:

R1. CPHEEO (2014), "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation", Government of India, New Delhi.

R2. George Tchobanoglous and FrankKreith (2002), "Handbook of Solid waste management", McGraw Hill, New York.

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U19CEPE010	GEOINFORMATICS APPLICATION FOR CIVIL ENGINEERS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To solve the Civil Engineering problems with the help of Geoinformatics technique.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Get knowledge about the land resource management.
CO2 : Study structural deformation and movement.
CO3 : Model soil characteristics, soil degradation assessment and management.
CO4 : Monitor urban growth and management of transport infrastructure.
CO5 : Model catchments and management of water resources**.**
CO6 : Plan and design the environmental conservation structures.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3	3	-	3	-	-	3	-	1	3	1	-
CO2	3	3	1	3	1	-	-	-	-	1	-	3	3	1	-
CO3	3	3	3	3	3	-	2	-	-	3	-	3	3	3	2
CO4	2	3	3	3	3	-	2	-	-	3	-	3	3	3	2
CO5	2	3	3	3	3	-	2	-	-	3	-	3	-	3	-
CO6	2	3	2	3	3	-	-	-	-	3	-	2	-	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I LAND RESOURCE MANAGEMENT 9

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 9

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 – modelling soil characteristics using satellite data – soil degradation assessment using Remote Sensing and GIS – Land reclamation studies.

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UNIT IV URBAN AND TRANSPORTATION MANAGEMENT 9

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 9

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 : 45 Hours

Textbooks:

T1. Basudeb Bhatta, "Remote Sensing and GIS", Second edition, Oxford University Press 2011.

T2. Lo.C.P., Albert K.W.Yeung, "Concepts and Techniques of Geographic Information Systems", Second edition, PHI Learning Private Limited, Delhi, 2014.

Reference Books:

R1. Andrew N. Rencz,, "Manual of Remote Sensing: Remote Sensing for Natural Resource Management and Environmental Monitoring", John Wiley & Sons Inc, April 2004.

R2. Rashed, Tarek; Jürgens, Carsten, "Remote Sensing of Urban and Suburban Areas", Springer, 1st Edition 2010.

R3. Harvey J. Miller, Shih-Lung Shaw, "Geographic Information Systems for Transportation – Principles and Applications", Oxford University Press 2001.

R4. Gert A. Schulitz Edwin T. Engman, "Remote Sensing in hydrology and Water Management", Springer – verlag Berlin Heidelberg Germany 2000.

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PROFESSIONAL ELECTIVE – III

		L	T	P	C
U19CEPE011	**INTERNET OF THINGS FOR CIVIL ENGINEERS**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provides the students,

- To discuss the architecture of IoT, sensors used in IoT and the role of IoT in Environmental Engineering.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Explain the definition and usage of the term "Internet of Things" in different contexts.
CO2 : Acquire basic understanding about the IoT.
CO3 : Acquire basic understanding about the Web of Things.
CO4 : Know about the application of various types of sensors used in IoT.
CO5 : Acquire knowledge the role of IoT in smart Cities**.**
CO6 : Monitor the environment with the help of IoT's.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	1	1	-	-	1	-	2	-	3	1	3	1
CO2	3	-	2	1	1	-	-	-	-	-	-	3	1	3	-
CO3	2	-	2	-	1	-	-	-	-	-	-	3	1	3	1
CO4	3	3	3	2	3	-	-	1	-	2	-	3	2	3	2
CO5	3	3	3	2	3	-	-	1	2	2	-	3	3	3	2
CO6	3	3	3	2	3	-	-	-	2	-	-	3	3	3	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION **10**

Definition and functional Requirements – Motivation – Architecture – Web3.0 View of IoT- Ubiquitous IoT applications – Four pillars of IoT – DNA of IoT – The Toolkit approach for End – user participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT – IoT Information Security.

UNIT II WEB OF THINGS **10**

Web of things versus Internet of things – Two pillars of the web – Architecture Standardization for WoT – Unified Multitier WoT Architecture. Cloud of Things: Grid/SOA and cloud computing – Mobile Cloud computing – The cloud of things.

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UNIT III IOT SENSORS 9

Introduction – Detectable phenomena – conversion methods – commonly measured quantities - Physical Principles – Selection of sensor – Need for sensor – role of sensor. Types of sensors: Requirements, Advantages, disadvantages and application – Pressures Sensor – Temperature sensor – Humidity sensor – chemical sensor – Accelerometer and gyroscope.

UNIT IV SMART CITY APPLICATION 8

Smart transportation – Intelligent parking – Autonomous Vehicle network. Smart buildings – Energy aware – inter building Navigation. Environmental sensing – Sustainable cities – City insights. Health monitoring of structures – Case studies.

UNIT V ENVIRONMENTAL MONITORING 8

Water management – Process – application. Air pollution Methods – advantages. Water monitoring – quality standards. Indication of calamities – alert systems – applications. Smart irrigation – case study. Micro climate monitoring.

Total : 45 Hours

Reference Books:

R1. The Internet of Things in the Cloud: A Middleware Perspective – Honbo Zhou – CRC Press – 2012.

R2. Architecting the Internet of Things – Dieter Uckelmann; Mark Harrison; Florian Michahelles (Eds.) Springer – 2011.

R3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World – David Easley and Jon Kleinberg, Cambridge University Press – 2010.

R4. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick – Wiley – 2012.

R5. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.

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U19CEPE012	BRIDGE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To know about various bridge structures, selection of appropriate bridge structures and its design for given site conditions.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Identify the various IRC standard live loads and design standards of bridges.

CO2 : Select the type of bridge based on the site condition.

CO3 : Analyse the super structure by various methods.

CO4 : Design the trussed bridge and plate girder bridges.

CO5 : Design reinforced concrete slab and T beam bridges and prestressed concrete bridges**.**

CO6 : Decide the appropriate sub structural systems, bearings and expansion joints for the bridges.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	3	-	1	3	2	1
CO2	3	1	2	1	-	-	2	-	-	3	-	1	3	2	1
CO3	3	3	2	3	-	-	-	-	-	3	-	3	3	2	-
CO4	3	3	3	2	-	-	-	-	-	3	-	3	3	2	-
CO5	3	3	3	2	-	-	-	-	-	3	-	3	3	2	-
CO6	3	3	3	2	-	-	-	-	-	3	-	3	3	2	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 9

History of bridges – Components of a bridge – Classification of road bridges – Selection of site and initial decision process – Survey and alignment; Geotechnical investigations and interpretations. River Bridge: Selection of Bridge site and planning – Collection of bridge design data – Hydrological calculation

Road Bridges – IRC codes – Standard Loading for Bridge Design – Influence lines for statically determinate and indeterminate structures – Transverse distribution of Live loads among deck longitudinal – Load combinations for different working state and limit state designs

Railway Bridges: Loadings for Railway Bridges; Railroad data. Pre-design considerations – Railroad vs. Highway bridges.

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UNIT II SUPERSTRUCTURES 9

Bridge decks – Structural forms and behaviour – Choices of superstructure types – Behaviour and modelling of bridge decks – Simple beam model – Plate model – Grillage method – Finite Element method – Different types of superstructures (RCC and PSC); Longitudinal Analysis of Bridge – Transverse Analysis of Bridge – Temperature Analysis – Distortional Analysis – Effects of Differential settlement of supports – Reinforced earth structures

UNIT III DESIGN OF STEEL BRIDGES 9

Design of Truss Bridges – Design of Plate girder bridges

UNIT IV DESIGN OF RC AND PSC BRIDGES 9

Design of slab bridges – T beam bridges – PSC bridges.

UNIT V SUBSTRUCTURE, BEARINGS AND EXPANSION JOINTS, PARAPETS AND RAILINGS 9

Substructure **–** Pier; Abutment – Wing walls – Importance of Soil-Structure Interaction – Types of foundations – Open foundation- Pile foundation- Well foundation- Simply supported bridge- Continuous Bridge – Bearings and Expansion Joints – Different types of bridge bearings and expansion joints – Parapets and Railings for Highway Bridges

Total : 45 Hours

Textbooks:

T1. Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 2009

T2. Jagadeesh. T.R. and Jayaram. M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2013

Reference Books:

R1. Phatak D.R., "Bridge Engineering", Satya Prakashan, New Delhi, 1990

R2. Ponnuswamy S., "Bridge Engineering", Tata McGraw-Hill, New Delhi, 1996

R3. Rajagopalan. N. "Bridge Superstructure", Alpha Science International, 2006

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U19CEPE013	GROUNDWATER ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers.
- To understand the techniques of development and management of groundwater.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Learn basic fundamentals of groundwater flow.
CO2 : Understand aquifer properties and its dynamics.
CO3 : Get an exposure towards well design and practical problems.
CO4 : Develop a model for groundwater management.
CO5 : Understand the importance of artificial recharge and groundwater quality concepts**.**
CO6 : Gain knowledge on conservation of groundwater.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	-	-	2	2	-	1	-	-	1	3	2	1
CO2	1	1	-	2	-	-	2	-	1	-	-	1	3	2	1
CO3	3	-	-	-	3	-	-	-	-	-	-	3	3	2	2
CO4	3	3	3	3	2	-	-	-	3	-	-	3	3	3	2
CO5	2	-	-	3	-	3	3	-	-	-	-	2	3	3	2
CO6	3	3	-	2	-	3	3	-	3	-	-	2	3	3	-

(3 – High, 2 – Medium, 1 – Low)

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 – GEC norms – Steady state flow – Darcy's Law – Groundwater Velocity – Dupuit Forchheimer assumption – Steady Radial Flow into a Well.

UNIT II WELL HYDRAULICS 9

Unsteady state flow – Theis method – Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method – tests – Image well theory – Partial penetrations of wells – Well losses – Specific Capacity and Safe yield – Collector well and Infiltration gallery.

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UNIT III GROUNDWATER MANAGEMENT 9

Need for Management Model – Database for Groundwater Management – Groundwater balance study – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition – Calibration – Validation – Future Prediction – Sensitivity Analysis – Uncertainty – Development of a model.

UNIT IV GROUNDWATER QUALITY 9

Ground water chemistry – Origin, movement and quality – Water quality standards – Drinking water – Industrial water – Irrigation water – Ground water Pollution and legislation – Environmental Regulatory requirements.

UNIT V GROUNDWATER CONSERVATION 9

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR)Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes.

Total : 45 Hours

Textbooks:

T1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.

T2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

Reference Books:

R1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.

R2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

R3. Rajagopalan. N. "Bridge Superstructure", Alpha Science International, 2006.

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U19CEPE014	PROFESSIONAL ETHICS IN ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To create an awareness on Engineering Ethics and Human Values, to instil Moral and Social Values and Loyalty and to appreciate the rights of others.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Learn various aspects with respect to society like civil virtue, honesty etc.

CO2 : Practise moral judgement in conditions of dilemma.

CO3 : Have and exposure Engineer's rights and responsibilities act in morally desirable ways, towards moral commitment and responsible conduct.

CO4 : Learn the need for concept of safety, risk assessment.

CO5 : Gain exposure to Environment Ethics & computer ethics; know their responsibilities and rights**.**

CO6 : Distinguish between ethical and non ethical issues.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	-	-	-	1	-	2	-	1	-	-	2	1	3
CO2	-	-	-	-	-	2	-	3	-	-	-	-	2	1	3
CO3	-	-	-	-	-	3	3	3	-	2	-	3	2	1	-
CO4	-	2	-	-	-	3	-	3	-	2	-	-	2	1	1
CO5	-	2	-	-	-	3	-	3	-	-	-	3	2	1	1
CO6	-	2	-	-	-	3	-	3	-	-	-	-	2	1	-

(3 – High, 2 – Medium, 1 – Low)

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's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

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UNIT III **ENGINEERING AS SOCIAL EXPERIMENTATION** **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

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 : 45 Hours

Textbooks:

T1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

T2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

Reference Books:

R1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.

R2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.

R3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

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U19CEPE015	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To give an overview of Traffic engineering, traffic regulation, management and traffic safety with integrated approach in traffic planning as well.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Analyse the traffic stream and its characteristics..

CO2 : Conduct traffic studies and analyse traffic data.

CO3 : Analyse various traffic control measures and design traffic engineering facilities.

CO4 : Understand the elements of traffic safety and approaches to accident studies.

CO5 : Evaluate the methods of traffic management and understand the role of Intelligent Transportation System**.**

CO6 : Use statistical concepts and applications in traffic engineering.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	1	-	-	-	-	1	2	-	1	3	1	2
CO2	3	2	2	1	-	-	-	-	1	2	-	1	2	1	2
CO3	3	3	2	-	3	-	-	-	1	2	-	1	2	3	3
CO4	3	-	-	3	-	-	-	-	-	3	-	3	3	3	-
CO5	3	3	2	3	3	-	-	-	-	3	-	3	3	3	1
CO6	3	3	3	3	-	-	-	-	-	3	-	3	3	1	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I TRAFFIC PLANNING AND CHARACTERISTICS 9

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including nonmotorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance

UNIT II TRAFFIC SURVEYS 9

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including nonmotorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance

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UNIT III TRAFFIC DESIGN AND VISUAL AIDS 9

Intersection Design – channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation – Traffic signs including VMS and road markings – Significant roles of traffic control personnel – Networking pedestrian facilities & cycle tracks

UNIT IV TRAFFIC SAFETY AND ENVIRONMENT 9

Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport

UNIT V TRAFFIC MANAGEMENT 9

Area Traffic Management System – Traffic System Management (TSM) with IRC standards –- Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

Total : 45 Hours

Textbooks:

T1. Kadiyali.L.R. “Traffic Engineering and Transport Planning”, Khanna Publishers, Delhi, 2013

T2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.

T3. Salter. R.I and Hounsell N.B, “Highway Traffic Analysis and design”, Macmillan Press Ltd. 1996.

Reference Books:

R1. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski,, “Principles of Highway Engineering and Traffic Analysis”, Wiley India Pvt. Ltd., New Delhi, 2011.

R2. Garber and Hoel, “Principles of Traffic and Highway Engineering”, CENGAGE Learning, New Delhi, 2010.

R3. SP:43-1994, IRC Specification, “Guidelines on Low-cost Traffic Management Techniques for Urban Areas”, 1994.

R4. Hobbs.F.D. “Traffic Planning and Engineering”, University of Brimingham, Peragamon Press Ltd, 2005

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PROFESSIONAL ELECTIVE – III

		L	T	P	C
U19CEPE016	**STRUCTURAL DESIGN**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provide the students,

- A solid background on the principles of structural engineering design.
- Knowledge of liquid retaining structures, bridges components, retaining wall and industrial structures.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Competence in concepts and theories of concrete design and applying these to solve structural engineering problems.

CO2 : Design and draw reinforced concrete Cantilever and Counterfort Retaining Walls.

CO3 : Design and draw flat slab as per code provisions.

CO4 : Design and draw reinforced concrete and steel bridges.

CO5 : Design and draw reinforced concrete and steel water tanks**.**

CO6 : Design and detail the various steel trusses and gantry girders.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	2	-	-	-	3	-	3	3	3	3
CO2	3	3	3	-	1	-	-	-	-	3	-	3	3	3	3
CO3	3	3	3	-	1	-	-	-	-	3	-	3	3	3	3
CO4	3	3	3	-	1	-	-	-	-	3	-	3	3	3	2
CO5	3	3	3	-	1	-	-	-	-	3	-	3	3	3	2
CO6	3	3	3	-	1	-	-	-	-	3	-	3	3	3	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I RETAINING WALLS 9

Reinforced concrete Cantilever and Counter fort Retaining Walls – Horizontal Backfill with Surcharge –Design of Shear Key – Design and Drawing.

UNIT II FLAT SLAB AND BRIDGES 9

Design of Flat Slabs with and without drops by Direct Design Method of IS code – Design and Drawing – IRC Specifications and Loading – RC Solid Slab Bridge – Steel Foot-over Bridge – Design and Drawing.

UNIT III LIQUID STORAGE STRUCTURES 9

RCC Water Tanks – On ground, Elevated Circular, underground Rectangular Tanks – Hemispherical Bottomed Steel Water Tank – Design and Drawing

`

UNIT IV INDUSTRIAL STRUCTURES 9

Structural steel Framing – Steel Roof Trusses – Roofing Elements – Beam columns – Codal provisions – Design and Drawing.

UNIT V GIRDERS AND CONNECTIONS 9

Plate Girders – Behaviour of Components – Deign of Welded Plate Girder – Design of Industrial Gantry Girders – Design of Eccentric Shear and Moment Resisting connections.

Total : 45 Hours

Textbooks:

T1. Krishnaraju N, "Structural Design and Drawing", Universities Press, 2009.

T2. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, "Comprehensive Design of Steel Structures", Laxmi Publications Pvt. Ltd., 2003.

Reference Books:

R1. Krishnamurthy D, "Structural Design and Drawing Vol I, II and III",CBS Publishers, 2010.

R2. Shah V L and Veena Gore, "Limit State Design of Steel Structures"

R3. IS800-2007, "Structures Publications", 2009.

R4. IS 456(2000) Indian Standard Plain and Reinforced Concrete-Code of Practice, Bureau of Indian Standards, New Delhi.

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U19CEPE017	ENVRIONMENTAL AND SOCIAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- The knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the historical evolution of impact assessment in selected parts of the world.

CO2 : Examine a range of environmental impact assessments.

CO3 : Knowledge and professional skills necessary to enable them to undertake environmental impact assessment.

CO4 : Develop idea about the protection of the environment from the significant adverse impact of proposed developments.

CO5 : Able to access different case studies/examples of EIA in practise.

CO6 : Able to identify mitigation measures to prevent the potential environmental impacts of a project.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	2	-	-	-	-	1	2	1	1
CO2	2	1	-	-	-	-	2	-	-	-	-	1	2	1	2
CO3	2	1	2	-	-	-	3	-	-	-	-	1	2	1	2
CO4	3	-	3	3	-	2	3	-	-	-	-	3	2	1	-
CO5	3	2	3	3	-	2	3	-	-	-	-	3	2	1	-
CO6	2	3	3	3	-	2	3	-	-	-	-	3	2	1	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION **9**

Impacts of Development on Environment – Rio Principles of Sustainable Development – Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle – EIA Notification and Legal Framework – Stakeholders and their Role in EIA – Selection & Registration Criteria for EIA Consultants.

UNIT II ENVIRONMENTAL ASSESSMENT **9**

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna – Matrices – Networks – Checklist Methods – Mathematical models for Impact prediction – Analysis of alternatives.

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UNIT III **ENVIRONMENTAL MANAGEMENT PLAN** **9**

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Review of EIA Reports – Public Hearing-Environmental Clearance Post Project Monitoring.

UNIT IV **SOCIO ECONOMIC ASSESSMENT** **9**

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan – Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT V **CASE STUDIES** **9**

EIA case studies pertaining to Infrastructure Projects – Real Estate Development – Roads and Bridges – Mass Rapid Transport Systems – Ports and Harbor – Airports – Dams and Irrigation projects – Power plants – CETPs – Waste Processing and Disposal facilities – Mining Projects.

Total : 45 Hours

Textbooks:

T1. Canter, R.L, "Environmental impact Assessment", 2nd Edition, McGraw Hill Inc, New Delhi,1995.

T2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank,1997.

T3. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers,2009.

Reference Books:

R1. Becker H. A., Frank Vanclay, "The International handbook of social impact assessment" conceptual and methodological advances, Edward Elgar Publishing, 2003.

R2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.

R3. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.

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U19CEPE018	PAVEMENT ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Knowledge on various IRC guidelines for designing rigid and flexible pavements.
- Assess quality and serviceability conditions of roads.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the different pavement layers and its functions.

CO2 : Understand different stresses, strain and deflection in flexible and rigid pavements.

CO3 : Design flexible pavement and rigid pavement as per provisions.

CO4 : Analyse the critical stress value and location by considering load and temperature stresses.

CO5 : Evaluate the condition of pavement and can assess the failure of pavement.

CO6 : Create a model for efficient pavement construction and management.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	1	2	-	-	2	-	2	3	2	3
CO2	3	3	2	3	-	-	-	-	-	2	-	2	3	2	2
CO3	3	3	3	3	-	2	3	-	-	3	-	3	3	2	2
CO4	3	3	1	3	-	2	3	-	-	3	-	3	3	2	1
CO5	3	3	1	1	-	-	-	-	-	-	-	3	3	2	-
CO6	3	3	3	1	-	2	-	-	-	2	-	3	3	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I TYPE OF PAVEMENT AND STRESS DISTRIBUTIONON LAYERED SYSTEM **9**

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 **9**

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 Westergaurd approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.

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UNIT IV PERFORMANCE EVALUATION AND MAINTENANCE 9

Pavement Evaluation – Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Ravelling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements – Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

UNIT V STABILIZATION OF PAVEMENTS 9

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 : 45 Hours

Textbooks:

T1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, "Highway Engineering", New Chand and Brothers, Revised 10th Edition, 2014.

T2. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna tech. Publications, New Delhi, 2005.

Reference Books:

R1. Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", John Wiley 2000.

R2. Guidelines for the Design of Flexible Pavements, IRC-37–2001, The Indian roads Congress, New Delhi.

R3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian Road Congress, New Delhi.

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U19CEPE019	HYDROLOGY AND WATER RESOURCE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understanding of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments.

CO2 : Construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge.

CO3 : Conduct Spatial analysis of rainfall data.

CO4 : Develop ideas of various types water storage reservoirs and application.

CO5 : Understand the concept and methods of ground water management.

CO6 : Apply math, science, and technology in the field of water resource Engineering.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	3	-	-	2	-	1	3	2	2
CO2	3	3	2	-	-	-	3	-	-	2	-	2	3	2	2
CO3	3	3	-	-	-	-	2	-	-	-	-	2	2	2	3
CO4	3	2	3	-	-	-	2	-	-	-	-	3	2	2	3
CO5	3	2	-	-	-	-	2	-	-	3	-	3	2	2	1
CO6	3	3	3	-	-	-	3	-	-	-	-	3	3	2	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I PRECIPITATION AND ABSTRACTIONS 9

Hydrological cycle – Meteorological measurements – Requirements, types and forms of precipitation – Rain gauges – Spatial analysis of rainfall data using Thiessen and Isohyet methods – Interception – Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression – Infiltration – Horton's equation – double ring infiltrometer, infiltration indices.

UNIT II RUNOFF 9

Watershed, catchment and basin – Catchment characteristics – factors affecting runoff – Run off estimation using empirical – Strange's table and SCS methods – Stage discharge relationships – flow measurements- Hydrograph – Unit Hydrograph – IUH

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UNIT III FLOOD AND DROUGHT 9

Natural Disasters – Flood Estimation – Frequency analysis – Flood control – Definitions of droughts - Meteorological, hydrological and agricultural droughts – IMD method – NDVI analysis – Drought Prone Area Programme (DPAP)

UNIT IV RESERVOIRS 9

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area – capacity – storage estimation, sedimentation – life of reservoirs – rule curve

UNIT V GROUNDWATER AND MANAGEMENT 9

Origin- Classification and types – properties of aquifers – governing equations – steady and unsteady flow – artificial recharge – RWH in rural and urban areas

Total : 45 Hours

Textbooks:

T1. Subramanya .K. "Engineering Hydrology" – Tata McGraw Hill, 2010

T2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.

T3. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

Reference Books:

R1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007

R2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.

R3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.

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U19CEPE020	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Facilitate the understanding of Quality Management principles and process.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Outline the dimensions and barriers regarding the quality.

CO2 : Understand the need for quality and barriers in achieving quality.

CO3 : Apply various principles used in the quality management.

CO4 : Gain knowledge in Six Sigma concepts.

CO5 : Apply tools and techniques of quality management to manufacturing and services processes.

CO6 : Apply the knowledge of ISO standards.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	2	-	2	-	-	-	1	1	1	2
CO2	2	3	-	1	-	2	-	1	-	-	-	1	1	1	2
CO3	3	-	2	-	-	1	-	-	-	-	-	1	1	1	2
CO4	-	3	3	3	2	1	-	3	-	-	-	3	1	3	1
CO5	2	-	-	-	3	2	-	-	-	-	-	3	1	3	1
CO6	3	3	3	3	2	3	-	2	-	-	-	3	3	3	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 9

Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II TQM PRINCIPLES 9

Leadership – Quality Statements, Strategic quality planning, Quality Councils – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal – Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

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UNIT IV TQM TOOLS AND TECHNIQUES II 9

Quality Circles – Cost of Quality – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction – Benefits of ISO Registration – ISO 9000 Series of Standards – Sector-Specific Standards – AS 9100, TS16949 and TL 9000 – ISO 9001 Requirements – Implementation – Documentation – Internal Audits – Registration. Environmental Management System**:** Introduction – ISO 14000 Series Standards – Concepts of ISO 14001 – Requirements of ISO 14001 – Benefits of EMS.

Total : 45 Hours

Textbooks:

T1. Dale H. Besterfiled, Carol B. Michna, Glen H. Besterfield, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

Reference Books:

R1. Janakiraman. B and Gopal.R.K., "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

R2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

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PROFESSIONAL ELECTIVE – V

		L	T	P	C
U19CEPE021	**BASICS OF DYANMICS AND SESMIC DESIGN OF STRUCTURES**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provide the students,

- The behaviour of dynamic loading. Study the effect of earthquake loading on the behaviour of structures.
- Codal provisions to design the structures as earthquake resistant.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Gain knowledge in the simulation and mathematical model development.
CO2 : Identify, formulate and solve complicated problem.
CO3 : Comprehend the role of natural calamity in the damage of structures.
CO4 : Develop the skill to analyse data and to apply the same in the practical problems.
CO5 : Apply the developed methodologies for the safe and stable design of structures.
CO6 : Analyse the codal provisions as well as the aseismic design methodology.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	-	1	-	-	-	-	2	2	1	3
CO2	3	3	2	3	-	-	1	-	-	-	-	2	2	1	-
CO3	3	3	2	2	2	-	1	-	-	3	-	3	2	-	3
CO4	3	3	3	3	-	-	1	-	-	-	-	3	2	-	3
CO5	3	3	3	3	-	-	1	-	-	-	-	2	2	-	-
CO6	3	3	3	3	-	-	-	-	-	1	-	2	2	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I SINGLE DEGREE OF FREEDOM SYSTEM 9

Definition of degree of freedom – Idealization of structure as Single Degree of Freedom (SDOF) system – Formulation of equation of motion for various SDOF system – D' Alemberts Principles – Effect of damping – Free and forced vibration of damped and undamped structures – Response to harmonic forces and periodic forces.

UNIT II MULTI DEGREE OF FREEDOM SYSTEM 9

Formulation of equation of motion for multi degree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors – Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods.

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UNIT III **INTRODUCTION TO EARTHQUAKE ENGINEERING** **9**

Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon – Seismotectonic – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters.

UNIT IV **EARTHQUAKE EFFECTS ON STRUCTURES** **9**

Effect of earthquake on different types of structures – Behaviour of RCC, Steel and prestressed Concrete Structures under earthquake loading – Pinching Effect – Bouchinger Effects – Evaluation of Earthquake forces – IS Code 1893: 2002 – Response Spectra – Lessons learnt from past earthquakes.

UNIT V **CONCEPTS OF EARTHQUAKE RESISTANT DESIGN** **9**

Causes of damage – Planning considerations/Architectural concept (IS 4326–1993) – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry buildings – Design consideration – Guidelines – Earthquake resistant design of R.C.C. buildings – Lateral load analysis – Design and detailing (IS 13920:1993).

Total : 45 Hours

Textbooks:

T1. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2007.

T2. Mario Paz, Structural Dynamics – Theory and Computations, Fourth Edition, CBS publishers, 1997.

Reference Books:

R1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.

R2. Jai Krishna, Chandrasekaran.A.R., and Brijesh Chandra, Elements of Earthquake Engineering, South Asia Publishers, 1994.

R3. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986

R4. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.

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U19CEPE022	MAINTENANCE REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- The knowledge on Quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Describe the mechanism of damages and types of damages.

CO2 : Understand the strength and durability properties, their effects due to climate and temperature.

CO3 : Use different types of special concrete such as polymer concrete sulphur infiltrated concrete, fiber reinforced concrete, ferro cement and expansive cement for rehabilitation works.

CO4 : Identify the proper the techniques for repair rand protection methods.

CO5 : Understand repair, rehabilitation and retrofitting of structures and demolition methods.

CO6 : Identify the causes for deterioration of structures and able to give the preventive measures for it.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	2	-	3	3	-	-	-	-	3	3	2	1
CO2	3	3	-	2	-	3	-	-	-	-	-	3	3	3	2
CO3	1	3	-	1	-	3	3	-	-	-	-	3	3	3	1
CO4	1	3	3	3	-	2	-	-	-	-	-	3	3	3	1
CO5	3	3	3	-	-	3	1	-	-	-	-	2	2	3	-
CO6	3	3	3	2	-	1	3	-	-	-	-	2	2	2	-

(3 – High, 2 – Medium, 1 – Low)

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 damaged structure, causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete–Strength, Durability – Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion.

UNIT III SPECIAL CONCRETES 9

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

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UNIT IV **TECHNIQUES FOR REPAIR AND PROTECTION METHODS** **9**

Non-destructive Testing Techniques, Load Test for Stability – Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

UNIT V **REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES** **9**

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake – Transportation of Structures from one place to other – Structural Health Monitoring – demolition techniques – Engineered demolition methods – Case studies

Total : 45 Hours

Textbooks:

T1. Vidivelli.B, "Rehabilitation of Concrete Structures", Standard Publishes Distribution.1st edition 2009.

T2. Varghese.P.C, "Maintenance Repair and Rehabilitation & Minor works of building", Prentice Hall India Pvt Ltd 2014.

T3. Shetty.M.S., "Concrete Technology-Theory and Practice", S.Chand and Company, 2008.

Reference Books:

R1. Ravishankar.K. Krishnamoorthy.T.S, "Structural Health Monitoring, Repair And Rehabilitation of Concrete Structures", Allied Publishers, 2004.

R2. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.

R3. Hand Book on "Repair and Rehabilitation of RCC Buildings", Director General works CPWD, Govt of India , New Delhi – 2002.

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U19CEPE023	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To give an idea about IPR, registration and its enforcement.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Differentiate and explain various forms of IPRs.

CO2 : Identify criteria's to fit one's own intellectual work in particular form of IPRs.

CO3 : Apply statutory provisions to protect particular form of IPRs.

CO4 : Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Design etc.

CO5 : Identify procedure to protect different forms of IPRs national and international level.

CO6 : Develop skill of making search using modern tools and technics.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	1	-	-	-	1	1	1	-
CO2	2	1	-	-	-	2	1	-	2	-	2	1	1	1	-
CO3	-	-	-	-	-	3	-	3	-	1	-	2	2	1	-
CO4	-	2	-	-	-	1	-	3	2	-	-	1	2	1	-
CO5	-	2	1	1	-	2	1	3	1	1	-	2	2	1	-
CO6	2	1	1	-	3	2	1	3	1	-	-	2	2	1	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION **9**

Introduction to IPRs, Basic concepts and need for Intellectual Property – Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs **10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS **10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

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UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

Total : 45 Hours

Textbooks:

T1. V. Scople Vinod, "Managing Intellectual Property", Prentice Hall of India Pvt Ltd, 2012.

T2. S. V. Satakar, "Intellectual Property Rights and Copy Rights", Ess Ess Publications, New Delhi, 2002.

Reference Books:

R1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.

R2. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.

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U19CEPE024	INTRODUCTION TO FINITE ELEMENT METHOD	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To develop a thorough understanding of the finite element analysis techniques with an ability to effectively use the tools of the analysis for solving practical problems arising in Civil Engineering.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Comprehend the different mathematics techniques used in FEM analysis.
CO2 : Comprehend the basics of finite element formulation.
CO3 : Formulate stiffness matrix for beam, truss and framed structures.
CO4 : Apply finite element formulations to solve one dimensional problems.
CO5 : Apply finite element method to solve two dimensional problems.
CO6 : Apply finite element method to analyse plate bending problems.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	1	-	-	1	-	-	2	3	1	3
CO2	3	3	1	1	1	1	-	-	3	-	1	1	3	2	3
CO3	3	3	2	1	1	1	-	-	3	-	1	1	3	2	3
CO4	3	3	1	2	2	1	-	-	3	-	2	1	3	1	-
CO5	2	3	1	1	2	1	-	-	3	-	1	2	3	1	-
CO6	3	3	2	1	3	2	-	-	3	-	1	2	3	1	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION **9**

Historical Background – Mathematical Modelling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems – Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II STIFFNESS MATRIX METHOD **9**

Introduction to Discrete and Continua elements – Discrete Elements - Direct stiffness method - Special characteristics of stiffness matrix - Assemblage of elements – Boundary condition & reaction - 2D – truss element - 2D - beam element - Analysis of framed Structures - Basic steps in finite element analysis - Differential equilibrium equations - strain displacement relation - linear constitutive relation - Numerical methods in finite element analysis - Gauss elimination method

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UNIT III ONE DIMENSIONAL PROBLEMS 9

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Continua Elements - Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function. Linear and quadratic elements Lagrange & Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector. Natural frequencies of longitudinal vibration and mode shapes

UNIT IV TWO DIMENSIONAL PROBLEMS 9

Two dimensional isoparametric elements - Four noded quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.

UNIT V ANALYSIS OF PLATES 9

Introduction – Specification regarding the slabs – Analysis of the Slabs for Moment and Shears – Introduction to Plate Bending Problems - displacement functions – Analysis of Thin Plate – Analysis of Thick Plate - Analysis of Skew Plate, Finite Element Analysis of Shell, plane stress and plane strain analysis, Example problem using any general-purpose finite element software.

Total : 45 Hours

Textbooks:

T1. Rao, S.S., "The Finite Element Method in Engineering", 6th Edition Butterworth Heinemann,2018.

T2. Reddy,J.N. "Introduction to the Finite Element Method", 4th Edition, Tata McGrawHill,2018.

Reference Books:

R1. Krishnamoorthy, C. S, "Finite Element Analysis - Theory and Programming", McGraw - Hill, 1995

R2. David Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.

R3. G.R. Liu and S.S.Quek, "Finite Element Method: A Practical Course", Butterworth-Heinemann; 1st edition (21 February 2003).

R4. S. S. Bhavikatti, "Finite Element Analysis", New Age Publishers, 2007

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U19CEPE025	ROCK ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To impart knowledge on fundamentals of rock mechanics and its application in solving simple problems associated with rock slopes and underground openings.
- The knowledge on the mechanics of rock and its applications in underground structures and rock slope stability analysis.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Use different rock mass classification systems such as Q system, the Rock Mass Rating (RMR) and the Geological strength Index (GSI).

CO2 : Comprehend the modes of rock failure, stares strain characteristics, failure criteria.

CO3 : Apply fundamental mechanics to understand the properties of intact rock and rock masses for civil engineering purposes.

CO4 : Analyse and derive the properties of rock from laboratory testing for the effective solutions of engineering problems through teamwork**.**

CO5 : Apply various type on rock stabilization.

CO6 : Analyse the typical stability problems in rock for tunnelling, slopes and foundations.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	1	1	-	-	-	-	-	2	3	2	-
CO2	2	3	2	3	1	1	-	-	-	-	-	3	3	3	-
CO3	3	1	2	1	-	-	-	-	-	-	-	2	3	3	3
CO4	3	1	2	-	1	1	-	-	3	-	-	2	3	2	3
CO5	3	2	1	-	-	-	-	-	-	-	-	3	3	2	-
CO6	3	2	1	1	-	-	-	-	3	-	-	3	3	2	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I CLASSIFICATION AND INDEX PROPERTIES OF ROCKS 9

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose – Rock Mass Rating and Q System.

UNIT II ROCK STRENGTH AND FAILURE CRITERIA 9

Modes of rock failure – Strength of rock – Laboratory measurement of shear, tensile and compressive strength. Stress - strain behaviour of rock under Hydrostatic compression and deviatoric loading – Mohr – Coulomb failure criteria and Hock and Brown empirical criteria.

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UNIT III INITIAL STRESSES AND THEIR MEASUREMENTS 9

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – measurements of in-situ stresses – Hydraulic fracturing – Flat jack method – Over coring method

UNIT IV APPLICATION OF ROCK MECHANICS IN ENGINEERING 9

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.

UNIT V ROCK STABILISATION 9

Introduction – Rock support and Rock reinforcement – Principles – Support reaction curves – Shotcreting.

Total : 45 Hours

Textbooks:

T1. Goodman, P.E. "Introduction to Rock Mechanics", John Wiley and Sons, 1999

T2. Stillborg B., "Professional User Handbook for rock Bolting", Tran Tech Publications, 1996

T3. Ramamurthy T., "Engineering in Rocks for Slopes Foundations and Tunnels", PHI Learning Pvt. Ltd., 3rd Edition, 2014

Reference Books:

R1. Brown, E.T., "Rock Characterisation Testing and Monitoring", Pergaman Press 1991

R2. Arogyaswamy, R.N.P., "Geotechnical Application in Civil Engineering", Oxford and IBH, 1991

R3. Brady, B.H.G. and Brown, E.T., "Rock mechanics for underground mining", (Third Edition), Kluwer Academic Publishers, Dordrecht, 2006

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OPEN ELECTIVE – I

		L	T	P	C
U19AEOE001	**AGRICULTURAL WASTE MANAGEMENT**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provide the students,

- To impart knowledge to students on various methods of agricultural waste management for eco-friendly energy and manure production.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Build various eco-friendly methods for agricultural waste management
CO2 : Develop the process of composting of different types of solid wastes
CO3 : Understand the techniques of briquetting from agro-residues
CO4 : Understand the role of biochar in soil nutrition and carbon sequestration
CO5 : Analyse Nutritive value and energy production potential of agro wastes
CO6 : Develop and understand the techniques for processing of ethanol and biogas production

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	3	3
CO3	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	1	1	-	-	-	-	-	-	-	-	-	-	3	3
CO6	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 10

Availability of different types of agriculture wastes - its overall characteristics – classification of agro wastes based on their characteristics - its recycling and utilization potential - current constraints in collection and handling of agricultural wastes – its environmental impact.

UNIT II COMPOSTING 8

Definition- Solid waste suitable for composting – Methods of composting - vermicomposting - Mineralization process in composting - Biochemistry of composting – Factors involved – Infrastructure required – maturity parameters – value addition – application methods

UNIT III BIOMASS BRIQUETTING 9

Definition – potential agro residues and their characteristics for briquetting – fundamental aspects and technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant-appliances for biomass briquettes.

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UNIT IV BIOCHAR PRODUCTION 9

Definition - characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – fast and slow pyrolysis – characteristics of Biochar – role of Biochar in soil nutrition and carbon sequestration

UNIT V BIOGAS AND BIO ETHANOL PRODUCTION 9

Screening of suitable lingo cellulosic substrate for biogas production -determination of bio-energy potential of agro-waste by estimating total solids - volatile solids - Calorific value- per cent total carbohydrates, moisture, lignin and cellulosic contents – preparation of feed stocks for anaerobic bio-digestion – types of digesters – factors affecting - nutrient value and utilization of biogas slurry. Ethanol production from lingo cellulosic wastes - Processing of Biomass to Ethanol –pre- treatment-fermentation-distillation

Total : 45 Hours

Textbooks:

T1. Rai G.D, "Non conventional sources of Energy", Khanna publishers, New Delhi, 1995.

T2. Diaz,l.F.,M. de Bertoldi and W. Bidlingmaier. 2007, "Compost science and technology", Elsevier pub.

Reference Books:

R1. P.D. Grover & S.K. Mishra, "Biomass Briquetting: Technology and Practices". Published by FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand, 1996.

R2. Magdalena Muradin and Zenon Foltynowicz, "Potential for Producing Biogas from Agricultural Waste in Rural Plants in Poland". Sustainability, 2014, 6, 5065-5074.

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U19AEOE002 **FARM MANAGEMENT**

L	T	P	C
3	0	0	3

Course Objectives:

This course aims,

- To impart the fundamental knowledge and basic concepts of Economics and Farm Management.
- To understand the types of resources and Investment analysis in agriculture sector
- To understand the Farm financial analysis, Investment and Budgeting for farms.
- To expose the students to different extension methods for communication to take the work from lab to field
- To plan the financial aspects, economics related to farm management in a cost effective manner.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Gain knowledge in various farm management and farm layout aspects
CO2 : Familiarize with the various laws of economics and product relationship aspects
CO3 : Gain knowledge on cost curves and its applications
CO4 : Understand about the various concepts of management of resources
CO5 : Gain knowledge on farm management and financial analysis
CO6 : Familiarize with budgeting and cost estimation for farm layout

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO6	2	3	2	1	-	-	-	-	-	-	-	-	-	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I FARM MANAGEMENT & PLANNING **9**

Farm Management – definition – scope- Classification of farms – Basic concepts in farm management - Relationship between farm management and other basic sciences - Farm layout – Farm records and accounts– Farm appraisal techniques – Valuation - Farm management- need and analysis –Elements of farm planning– Whole farm planning and partial planning – Farm level management system – Farm budgeting – whole farm budgeting and partial budgeting – Estimation of credit - examples of farm planning and budgeting.

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UNIT II LAWS OF ECONOMICS 9

Agricultural Economics – definition and scope – Basic laws of economics – demand and supply concepts – law of increasing, diminishing and constant returns – Equi-marginal returns - Product relationship – Production function – definition and types – Production function curves – Optimum level of input use – Economies of scale external and internal economies and diseconomies - Cost concepts – types – Opportunity cost – comparison of costs – Factor relationship – concepts.

UNIT III COST CURVES 9

Principle of substitution – isoquant, isocline, expansion path, ridge line and least cost combination of inputs-Product-product relationship – Production possibility curve, iso revenue line and optimum combination of outputs – Cost curves –Optimum input and output levels – Factor &relationship – Least cost combination of inputs – Estimation of cost of cultivation and cost of production of crops - annual and perennial crops

UNIT IV MANAGEMENT OF RESOURCESAND FINANCIAL ANALYSIS 9

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis –Investment analysis – Discounting techniques- Farm financial analysis – Balance sheet – Income statement – Cash flow analysis – Farm investment analysis – Time comparison principles - Preparation of interview schedule and farm visit for data collection.

UNIT V AGRICULTURAL EXTENSION 9

Communication – models – elements and their characteristics – types and barriers - Programme planning – monitoring and evaluation - Extension teaching methods - Audio-Visual aids – classification – purpose, planning and selection – individual, group and mass contact methods –Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone – Diffusion - Adoption –Capacity building of extension personnel and farmers –types of training, training to farmers, farm women and rural youth, FTC & KVK.

Total : 45 Hours

Textbooks:

T1. Johl, S.S., and Kapur, T.R., "Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007

T2. Subba Reddy, S., Raghu Ram, P., Neelakanta Sastry T.V and Bhavani 3. Devi, I., "Agricultural Economics" Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.

Reference Books:

R1. Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.

R2. Subba Reddy, S., and Raghu Ram, P. „ "Agricultural Finance and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.

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U19BTOE001	BASICS OF BIOINFORMATICS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To improve the programming skills of the student.
- To let the students know the recent evolution in biological science.

Course Outcomes:

At the end of the course students will be able to,

CO1: Use bioinformatics tools with programming skills.

CO2: Apply computational based solutions for biological perspective.

CO3: Alignment of nucleotide and protein sequences.

CO4: Predict gene and protein structure.

CO5: Construct, interpret and assess the different molecular phylogenetic tree prediction and gene prediction algorithms.

CO6: understand the Application of Bioinformatics.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	2	3	-	-	-	-	-	-	-	-	1
CO3	-	-	2	-	3	3	-	-	-	-	-	-	-	-	1
CO4	-	3	2	-	-	2	-	-	-	-	-	-	-	1	1
CO5	-	-	2	-	2	3	-	-	-	-	-	-	-	2	-
CO6	1	-	-	-	1	-	-	-	-	-	-	-	-	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I DATABASES 9

Introduction to Bioinformatics - Biological information resources - Genome sequence acquisition and analysis - Retrieval of biological data - Data acquisition, databases, structure and annotation - Data mining and data characteristics.

UNIT II SEQUENCE ALIGNMENT AND DATABASE SEARCHES 9

Database searches and Sequence Alignment - Pair wise and multiple sequence alignment-Methods of local and global alignment - Dynamic programming, Scoring matix, PAM, searching sequence databases by sequence similarity - BLAST and FASTA.

UNIT III PHYLOGENY ANALYSIS 9

Phylogenetics, Molecular Phylogeny and evolutionary analysis - ClustalW, MSA, Dendrogram- Maximum likelihood, Maximum Parsimony, convergent and parallel evolution, Bootstrapping, Jack knifing - Phylograms.

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UNIT IV STRUCTURAL BIOINFORMATICS 9

Structural bioinformatics, analysis for protein structure, Predicting protein structure and function from Sequence-Homology modelling - Microarray Data analysis - proteomic data analysis-Visualization of molecular structures.

UNIT V APPLICATIONS OF BIOINFORMATICS 9

Scope of bioinformatics - Bioinformatics in the Pharmaceutical Industry - Structure based Rational Drug Design and discovery – Chemi informatics in Biology.

Total : 45 Hours

Textbooks:

T1. Attwood, T. and P.S. David. 2006. Introduction to Bioinformatics. Pearson Education Ltd., New York.

T2. Axevanis, A.D., and Ouellette, B.F.F. (eds) 2006. Bioinformatics A Practical Guide to Analysis of Genes and Proteins. 3rd Edition, John Wiley and Sons, New York.

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U19BTOE002	INTRODUCTION TO BIOENERGY AND BIOFUELS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To provide focus on achievement, acquisition of knowledge and enhancement of comprehension of information regarding bioenergy and biofuel technologies and their sustainable applications.

Course Outcomes:

At the end of the course students will be able to,

CO1: Understand in depth of the bioenergy and biofuels.
CO2: Distinguish various forms of bioenergy and biofuels production
CO3: Analyze concepts related to and advantages of bioenergy.
CO4: Develop novel products from biofuels.
CO5: Understand the environmental sustainability.
CO6: Understand the yield and efficiency of Biofuels.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	2	2	-	1	3	-	-	-	-	2	-
CO4	3	1	1	-	-	1	-	1	-	-	-	-	-	1	-
CO5	3	3	2	1	2	-	-	1	-	-	-	-	-	1	-
CO6	3	3	2	1	2	-	-	1	-	-	-	-	-	1	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I BASIC CONCEPTS OF BIO-FUELS 9

Biopower, Bioheat, Biofuesl, advanced liquid fuels, drop-in fuels, biobased products

UNIT II FEEDSTOCKS 9

Harvested Feedstocks: First generation biofuels, Second generation biofuels, third generation biofuels. Residue Feedstocks: Agricultural wastes, forestry wastes, farm waste, organic components of residential, commercial, institutional and industrial waste.

UNIT III CONSERVATION TECHNOLOGIES 9

Biorefinery concept – biorefineries and end products, Biochemical conversion – hydrolysis, enzyme and acid hydrolysis, fermentation, anaerobic digestion and trans-esterification, Thermochemical conversion – Combustion, Gasification, Pyrolysis, other thermochemical conversion technologies. Scaling up of emerging technologies.

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UNIT IV BIOMETHANE AND BIOHYDROGEN 9

Biomethanol − Principles, materials and feedstocks, Process technologies and techniques, Advantages and limitations − Biological hydrogen production methods, Fermentative hydrogen production, Hydrogen economy − Advantages and limitations

UNIT V SUSTAINABILITY AND RESILIENCE 9

Environmental Sustainability, bioenergy sustainability, emissions of biomass to power generation applications, emissions from biofuels. ILUC issues, Carbon footprint, Advanced low carbon fuels.

Total : 45 Hours

Textbooks:

T1. Robert C Brown., "Bio renewable Resources – Engineering new product". Blackwell Publishing Professional, 2003.

T2. Donald Klass , "Biomass for Renewable Energy, Fuels and Chemicals". Academic press. 1999

T3. Vaughn C. Nelson and Kenneth L. Starcher, "Introduction to Bioenergy"

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U19BMOE001	BIO HEALTHCARE AND TELEMEDICINE	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To enable the students to acquire knowledge about the principles and application of telemedicine in biomedical industry

Course Outcomes:

At the end of the course students will be able to,

CO1: Explain the development and transmission techniques used in telemedicine.
CO2: Describe the types of communication and network systems.
CO3: Explain the technologies used in data exchange and privacy of telemedicine.
CO4: Illustrate the current system of tele-health and mobile health.
CO5: Describe the currents and futures perspective of telemedicine.
CO6: Acquire knowledge about the principles and application of telemedicine.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	-	-	-	-	-	-	-	-	2	2	-
CO2	2	2	3	1	-	-	-	-	-	-	-	-	2	2	-
CO3	2	2	3	1	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	3	1	-	-	-	-	-	-	-	-	2	2	-
CO5	3	2	3	1	-	-	-	-	-	-	-	-	3	2	-
CO6	2	2	3	1	-	-	-	-	-	-	-	-	2	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I BACKGROUND OF TELEMEDICINE 9

Introduction, definitions of telemedicine - telehealth and telecare - Origins and development of telemedicine: from beginning to modern times - modern telemedicine and telecare Drivers of telemedicine and telecare: technology drivers - non technological drivers - the funding dilemma Telemedicine in developed and underdeveloped countries - benefits and limitations of telemedicine Types of information and transmission in telemedicine: audio, video, still images, text and data, Fax.

UNIT II COMMUNICATION AND NETWORK SYSTEMS IN TELEMEDICINE 9

Types of communication and network: public switched telephone network - plain old telephone service, integrated services digital network, internet - asynchronous transfer mode Wireless communications basics and its types Wireless sensor standards and homecare concerns - medical sensors for mobile communication devices. Development of disposable adhesive wearable human monitoring system Implantable systems: implantable system architecture Signal Processing in implantable neural recording microsystems - electronic health signal processing

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UNIT III **TECHNOLOGIES FOR SAFEGUARDING MEDICAL DATA AND PRIVACY** **9**

Data Exchanges: Network configuration - circuit and packet switching - H.320 series Data security and standards: Encryption – cryptography - mechanisms of encryption - phases of encryption Cryptography - safeguarding patient medical history Anonymous data collection and processing - biometric security and identification.

UNIT IV **TELEHEALTH AND MOBILE HEALTH** **9**

Medical robotics: surgical robots - rehabilitation robots Modern devices for tele-surgery: Main component and functionalities of a robotics tele-surgery System - design guidelines and methodology Microsurgery Systems: Robot-assisted microsurgery system – miniaturization - microsurgical tools - visualization methods and systems Image-guided microsurgery: Image guidance component and workflow - image guidance by surgical domain.

UNIT V **IMPLEMENTATION OF TELEMEDICINE AND FUTURE TRENDS IN TECHNOLOGY** **9**

Telecardiology: Tools and devices Teleradiology and Tele-audiology Telepathology system development and implementation Acute care telemedicine and monitoring for elderly care Virtual doctor systems for medical practices - wireless electrical impedance tomography Synthetic biometrics in biomedical systems - bio-kinematics for mobility

Total : 45 Hours

Textbooks:

T1. Bernard Fong, A.C.M. Fong, C.K. Li, ―Telemedicine Technologies: Information Technologies in Medicine and Telehealth‖, Wiley, 1st edition, 2010.

T2. Halit Eren, John G.Webster, "The E-Medicine, E-Health, M-Health, Telemedicine and Telehealth Handbook", CRC Press,1st edition, 2015.

T3. Olga Ferrer Roca, M.Sosa Ludicissa,"Handbook of Telemedicine", IOS press,1st edition,2002

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U19BMOE001	EMBEDDED SYSTEMS IN MEDICAL DEVICES	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To Understand the design of embedded system for various medical devices.

Course Outcomes:

At the end of the course students will be able to,

CO1: Attain knowledge on the basic concepts and the building blocks for embedded system.
CO2: Understand the hardware and software partitioning in embedded systems.
CO3: Gain knowledge about timers and memory organization of embedded systems.
CO4: Design a pulse oximeter using embedded tool.
CO5: Design a pacemaker using embedded tool**.**
CO6: Understand the design of embedded system for various medical devices.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	-	-	-	-	2	2	3	3	-
CO2	2	2	2	2	2	2	-	-	-	-	2	2	3	3	-
CO3	3	3	2	3	2	1	-	-	-	-	2	2	2	2	-
CO4	3	3	3	2	2	2	-	-	-	-	2	2	2	2	-
CO5	2	2	2	3	2	1	-	-	-	-	2	2	2	2	-
CO6	2	2	2	2	2	1	-	-	-	-	2	2	2	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I EMBEDDED DESIGN WITH MICROCONTROLLERS 9

Product specification – hardware / software partitioning - Detailed hardware and software design – integration, product testing - Microprocessor Vsmicro controller - Performance tools, bench marking processors - RTOS micro controller - issues in selection of processors.

UNIT II PARTITIONING DECISION 9

Hardware / software duality – Hardware - software portioning, coding for hardware/software development, ASIC revolution - Managing the risk, co-verification, execution environment- Memory organization of controller, memory enhancement - Firmware, speed and code density, system startup.

UNIT III FUNCTIONALITIES FOR SYSTEM DESIGN 9

Timers, watch dog timers - RAM, flash memory, basic toolset, integration of hardware & firmware- Application programming, IDE, target configuration- Host based debugging analyser- Remote debugging, ROM emulators, logic

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UNIT IV DESIGN OF PATIENT MONITORING DEVICES 9

Design consideration of patient monitoring systems- Basic block diagram of pulse oximeter, design requirement of device- Circuit implementation of interfacing of oximeter sensors with microcontroller- Software coding and implementation.

UNIT V DESIGNING OF PACEMAKER 9

System description of pacemaker- Design requirement and basic block diagram of pacemaker- Interfacing of pacemaker elements with processors- Software coding of pacemaker and implementation.

Total : 45 Hours

Textbooks:

T1. James K. Peckol, "Embedded system Design", John Wiley & Sons, 1st edition, 2010.

Reference Books:

R1. Geo EliciaWhite, "Making Embedded Systems", O'ReillySeries, SPD,1stedition,2011.

R2. Georgi Graschew Stefan Rakowsky, "Telemedicine Techniques and Applications,In Tech", 1stedition,2011

R3. G. Baura, "A Biosystems Approach to Industrial Patient Monitoring and Diagnostic Devices", Morgan & Claypool, IEEE,2008

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U19CEOE001	GREEN BUILDINGS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To imbibe basics of green design and sustainable development concept.
- To identify various area of implementing strategies for green design in projects to enhance built environment.
- To learn institutional guidelines for development and certification of green designs.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Identify about the importance and necessity of green buildings

CO2 : Comprehend the principles of green building certifications (LEED) and low-energy building strategies.

CO3 : Comprehend the concepts and principles in Green Building Design.

CO4 : Suggest materials and technologies to improve energy efficiency of building**.**

CO5 : Generate ideas about various green composites used in building and sustainable development.

CO6 : Have an Insight about criteria for rating systems along with established Indian codes an guideline.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	1	3	-	3	-	-	-	-	2	2	1	3
CO2	2	1	3	2	1	2	3	-	-	-	-	1	2	1	3
CO3	2	2	2	3	1	1	3	-	-	-	-	3	2	1	3
CO4	-	-	1	-	-	-	3	-	-	-	-	2	2	1	3
CO5	2	-	1	2	1	-	3	-	-	-	-	3	3	1	3
CO6	3	2	1	2	-	1	3	-	-	-	-	1	3	3	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 9

Green Building - Need for Green Building - Benefits of Green Buildings - Green Building Materials and Equipment in India - Key Requisites for Constructing a Green Building - Important Sustainable features for Green Building.

UNIT II GREEN BUILDING CONCEPTS AND PRACTISES 9

Indian Green Building Council - Green Building Moment in India - Benefits Experienced in Green Buildings - Launch of Green Building Rating Systems - Residential Sector - Market Transformation. Green Building Opportunities And Benefits: Opportunities of Green Building - Green Building Features, Material and Resources - Water Efficiency - Optimum Energy Efficiency - Typical Energy Saving Approach in Buildings - LEED India Rating System and Energy Efficiency.

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UNIT III GREEN BUILDING DESIGN 9

Introduction - Reduction in Energy Demand - Onsite Sources and Sinks - Maximise System Efficiency - Steps to Reduce Energy Demand and Use Onsite Sources and Sinks - Use of Renewable Energy Sources. Eco-friendly captive power generation for factory - Building requirement.

UNIT IV UTILITY OF SOLAR ENERGY IN BUILDINGS 9

Utility of Solar energy in buildings. Concepts of Solar Passive Cooling and Heating of Buildings - Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

UNIT V GREEN COMPOSITES FOR BUILDINGS 9

Concepts of Green Composites - Water Utilisation in Buildings - Low Energy Approaches to Water Management, Management of Solid Wastes, Management of Sullage Water and Sewage, Urban Environment and Green Buildings, Green Cover and Built Environment.

Total : 45 Hours

Textbooks:

T1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. "Alternative Building Materials and Technologies". New Age International, 2007.

T2. Low Energy Cooling for Sustainable Buildings. John Wiley and Sons Ltd, 2009.

T3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

Reference Books:

R1. Osman Attmann, "Green Architecture Advanced Technologies and Materials". McGraw Hill, 2010.

R2. Jerry Yudelson, "Green building Through Integrated Design". McGraw Hill, 2009.

R3. Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke.

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U19CEOE002	DISASTER PREPARDNESS AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To Understand the basic concepts of disaster management.
- To acquire knowledge on types and categories of disasters.
- To understand the impacts and challenges posed by disasters.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Comprehend the foundations of hazards, disasters and associated natural/social phenomena.

CO2 : Familiar with disaster management theory (cycle, phases) and Methods of community involvement as an essential part of successful DRR.

CO3 : Apply knowledge about existing global frameworks and existing agreements.

CO4 : Understand consequences and inter relationship between development and disasters**.**

CO5 : Draw the hazard and vulnerability profile of India, Scenarios in the Indian context.

CO6 : Conduct independent DM study including data search, analysis and presentation of disaster case study.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	1	3	3	-	-	1	-	2	3	1	1
CO2	-	2	1	1	2	2	3	-	3	-	-	2	2	1	-
CO3	-	3	2	1	-	3	1	-	3	-	-	2	2	1	-
CO4	3	3	-	1	3	3	2	-	-	-	-	2	3	1	-
CO5	-	3	2	1	3	3	2	-	-	3	-	2	3	1	3
CO6	3	3	2	-	1	3	2	-	-	-	-	-	2	1	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO DISASTER 9

Concepts and definitions - disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation. Global trends in disasters - urban disasters, pandemics, complex emergencies, Climate change. Disaster's classification - natural disasters - manmade disasters - hazard and vulnerability profile of India - mountain and coastal areas, ecological fragility. Dos and Don'ts during various types of Disasters.

UNIT II DISASTER IMPACTS 9

Disaster impacts (environmental, physical, social, ecological, economic, political, etc.) - health, psycho, social issues - demographic aspects (gender, age, special needs) - hazard locations - global and national disaster trends - climate change and urban disasters.

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UNIT III DISASTER RISK REDUCTION 9

Disaster management cycle – its phases : prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures - risk analysis - vulnerability and capacity assessment - early warning systems - Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications) - Roles and responsibilities of government – community - local institutions - NGOs and other stakeholders - Policies and legislation for disaster risk reduction - DRR programmes in India and the activities of National Disaster Management Authority

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTERS, ENVIRONMENT AND DEVELOPMENT 9

Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmentally friendly recovery; reconstruction and development methods.

Total : 45 Hours

Textbooks:

T1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010.

T2. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.

T3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.

Reference Books:

R1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.

R2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.

R3. Government of India, National Disaster Management Policy,2009.

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U19CSOE001	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modelling.
- To understand the various software design methodologies.
- To learn various testing and maintenance measures

Course Outcomes:

At the end of the course students will be able to,

CO1 : Identify the key activities in managing a software project and recognize different process model.
CO2 : Explain the concepts of requirements engineering and Analysis Modeling.
CO3 : Outline the systematic procedures for software design and deployment.
CO4 : Compare various testing and maintenance methods**.**
CO5 : Interpret the project schedule, estimate project cost and effort required.
CO6 : Develop a software using the software engineering principles.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO6	3	2	2	-	-	-	-	-	-	-	-	-	-	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility - Agile process - Extreme programming-XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

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UNIT III SOFTWARE DESIGN 9

Design process – Design Concepts - Design Model – Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow - User Interface Design: Interface analysis, Interface Design – Component level Design: Designing Class based components, traditional Components..

UNIT IV TESTING AND MAINTENANCE 9

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing - Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices – Refactoring - Maintenance and Reengineering - BPR model - Reengineering process model-Reverse and Forward Engineering..

UNIT V PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification - RMMM Plan - CASE TOOLS.

Total : 45 Hours

Textbooks:

T1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", 7th Edition, Mc Graw-Hill International Edition, 2010

T2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011

Reference Books:

R1. Rajib Mall, "Fundamentals of Software Engineering", 3rd Edition, PHI Learning Private Limited, 2009.

R2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

R3. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007

R4. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

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U19CSOE002	DATABASE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To have an introductory knowledge about the Storage and Query processing Techniques

Course Outcomes:

At the end of the course students will be able to,

CO1 : Discuss the fundamental concepts of relational database and SQL.

CO2 : Use ER model for Relational model mapping to perform database design effectively.

CO3 : Summarize the properties of transactions and concurrency control mechanisms.

CO4 : Outline the various storage and optimization techniques.

CO5 : Compare and contrast various indexing strategies in different database systems.

CO6 : Explain the different advanced databases.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	3	3
CO3	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	1	1	-	-	-	-	-	-	-	-	-	-	3	3
CO6	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I RELATIONAL DATABASES **9**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL – Dynamic SQL

UNIT II DATABASE DESIGN **9**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

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UNIT III TRANSACTIONS **9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery

UNIT IV TESTING AND MAINTENANCE **9**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

UNIT V PROJECT MANAGEMENT **9**

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

Total : 45 Hours

Textbooks:

T1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.

T2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2011.

Reference Books:

R1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.

R2. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, McGraw-Hill College Publications, 2015.

R3. G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011

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U19ECOE001	SOFT COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Apply suitable neural computing techniques for various applications

CO2 : Explain various ANN models

CO3 : Apply fuzzy concepts for various applications

CO4 : Apply genetic algorithms to solve problems

CO5 : Integrate various soft computing techniques for complex problems.

CO6 : Analyse neural techniques for various applications.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO2	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO3	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO4	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO5	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO6	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO SOFT COMPUTING **9**

Introduction - Artificial Intelligence - Artificial Neural Networks - Fuzzy Systems - Genetic Algorithm and Evolutionary Programming - Swarm Intelligent Systems - Classification of ANNs - McCulloch and Pitts Neuron Model - Learning Rules: Hebbian and Delta - Perceptron Network - Adaline Network - Madaline Network.

UNIT II ARTIFICIAL NEURAL NETWORKS **9**

Back propagation Neural Networks - Kohonen Neural Network - Learning Vector Quantization - Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks - Support Vector Machines - Spike Neuron Models.

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UNIT III FUZZY SYSTEMS 9

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations - Membership Functions - Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV GENETIC ALGORITHMS 9

Basic Concepts- Working Principles – Encoding - Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion - Mutation Operator - Bit-wise Operators - Convergence of Genetic Algorithm.

UNIT V HYBRID SYSTEMS 9

Hybrid Systems - Neural Networks, Fuzzy Logic and Genetic - GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy Art Map: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

Total : 45 Hours

Textbooks:

T1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.

T2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.

T3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

Reference Books:

R1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2002.

R2. Kwang H.Lee, “First course on Fuzzy Theory and Applications”, Springer, 2005.

R3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1996.

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U19ECOE006	MEDICAL ELECTRONICS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters.
- To study about the various assist devices used in the hospitals.
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Know the human body electro- physiological parameters and recording of bio-potentials

CO2 : Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.

CO3 : Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators.

CO4 : Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies and bio-telemetry principles and methods.

CO5 : Know about recent trends in medical instrumentation.

CO6 : Implement application of instruments.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO2	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO3	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO4	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO5	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO6	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of bio medical signals - Bio-potentials - Biopotential electrodes - biological amplifiers - ECG, EEG, EMG, PCG - typical waveforms and signal characteristics.

UNIT II NON ELECTRICAL PARAMETER MEASUREMENTS 9

Blood flow meter - Types, Cardiac output measurements - Types, respiratory measurement, blood pressure measurement, temperature and pulse measurement, Blood Cell Counters.

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UNIT III THERAPEUTIC EQUIPMENTS **9**

Cardiac pacemakers - Types, Cardiac defibrillators - Types, Dialyzers, Heart Lung Machines – Oxygenations, Diathermies - Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy.

UNIT IV MEDICAL IMAGING **9**

X-Ray machine, computer axial tomography - CT scans, Positron Emission Tomography - PET Scans. MRI and NMR Ultrasonic Imaging systems, Medical Thermograph.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION AND APPLICATION IN MEDICINE **9**

Bio medical telemetry- remote patient monitoring systems, Telemedicine, Radio pill, Application of cryogenics in medicine, Application of LASERS in medicines. Diagnosis of Cancers and tumors using image processing, diagnosis of dental plague using image processing, diagnosis of various eye problems using image processing.

Total : 45 Hours

Textbooks:

T1. Leslie Cromwell, Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, 2007.

T2. Khandpur, R.S., -Handbook of Biomedical Instrumentation‖, TATA McGraw-Hill, New Delhi, 2003.

Reference Books:

R1. Dhake .A.M, " Television and Video Engineering", Mc graw Hill, New Delhi, India, 2006

R2. Modern television practice: Transmission, reception and applications, New age International, New Delhi, 2015.

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U19EEOE001	RENEWABLE ENERGY RESOURCES	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To get exposure on renewable energy source.
- To know about the solar radiation and its environmental impact to power.
- To learn about the wind energy and its economic aspects.
- To know about geothermal energy with other energy sources.
- To get exposure on distributed generation in storage systems

Course Outcomes:

At the end of the course students will be able to,

CO1 : Acquire knowledge on power demand scenario of world and the importance of renewable energy sources in meeting the power demand

CO2 : Understand the working principle of solar photovoltaic system and its applications

CO3 : Outline the various components and performance of wind energy conversion system

CO4 : Explain the operation of geothermal and tidal power plants, fuel cell and ocean thermal energy conversion scheme.

CO5 : Understand the necessity of distributed generation and energy storage elements.

CO6 : Understand about the power generation through renewable energy sources

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	2	-	1	3	-	-	-	2	-	3	3	2
CO2	3	-	2	2	-	1	3	-	-	-	2	-	2	2	2
CO3	3	-	2	2	-	1	3	-	-	-	2	-	2	3	3
CO4	3	-	2	2	-	1	3	-	-	-	2	-	1	2	2
CO5	3	-	2	2	-	1	3	-	-	-	2	-	2	2	2
CO6	3	-	2	2	-	1	3	-	-	-	2	-	3	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION **9**

Energy scenario: National and International – Energy resources and their availability – Conventional power generation plant (Thermal power plant) - Environmental aspects of fossil fuels – Necessity for renewable energy sources – Types of renewable energy source and its limitation.

UNIT II SOLAR PHOTOVOLTAIC SYSTEM **9**

Introduction – Solar radiation and measurements – Basic principle of SPV conversion – Solar energy collectors – Solar energy storage: Solar pond – Types of solar PV cells – PV cell connections – Characteristics of PV module and its parameters - Application of solar energy: Solar pumping and solar cooking.

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UNIT III WIND ENERGY SYSTEM 9

Introduction – Wind energy conversion – Power produced from wind - Relationship between wind speed and power – Components of wind power plant (WPP) – Types of WPP – Selection of site for WPP – Advantages and challenges of WPP.

UNIT IV ENERGY FROM OTHER SOURCES 9

Geothermal energy (GTE): operation of GTE power plants – Types – Advantage of GTE - Tidal energy: Operation of tidal power plant – Ocean Thermal Energy Conversion system: Open and closed cycles - Fuel cell: Construction and working principle - Advantage and applications of Fuel cell.

UNIT V DISTRIBUTED GENERATION 9

Concept of DG – Benefits of DG – Types of DG resources – Security issues in integrating DG with power grid - Energy storage elements: Batteries, super-capacitors, flywheels - Captive power plants.

Total : 45 Hours

Textbooks:

T1. Rai, G.D., "Non-Conventional Energy Sources", Khanna Publishers, Sixth Edition 2017.

T2. Khan, B.H, Non-Conventional Energy Resources", Mc. Graw Hill Education Ltd, third reprint 2017

Reference Books:

R1. Rao S. Paruklekar, B.B, "Energy Technology – Non Conventional, Renewable and Conventional", Khanna Publishers,1994

R2. John Twidell and Tony Weir, "Renewable Energy Resources", Taylor and Francis Publications, Third edition, 2015.

R3. Mukund R.Patel, "Wind and Solar Power Systems", CRC Press LLC.

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U19EEOE002	INTRODUCTION TO CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To understand the concepts of control systems-open loop and closed loop control systems.
- To understand the (mathematical modelling) Transfer function from mechanical, electrical, block diagram and signal flow graph.
- To learn the concepts of steady state and transient responses from first and second order systems at different inputs and also steady state errors.
- To learn the stability concepts are Root locus, Bode plot and Polar plot
- To learn the concept of state space analysis applying on multi-input/output state of the system to find the stability.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Find the Mathematical models-differential equations, impulse response and transfer functions.

CO2 : find the transfer function from mechanical, electrical, block diagram, signal flow graph and electronic system.

CO3 : Describe the concept of steady state and transient response at different inputs.

CO4 : Apply the concepts of stability in s-domain and Routh criteria and the concepts of plotting the response of a system on a graph.

CO5 : Design and implement any system using state space analysis.

CO6 : Implement the real time applications of control systems.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	-	-	2	-	-	2	-	-	2	2	2	2
CO2	1	2	3	-	-	2	-	-	2	-	-	2	2	2	2
CO3	1	2	3	-	-	2	-	-	2	-	-	2	2	3	3
CO4	1	2	3	-	-	2	-	-	2	-	-	2	1	2	2
CO5	1	2	3	-	-	2	-	-	2	-	-	2	2	2	1
CO6	1	2	3	-	-	2	-	-	2	-	-	2	3	2	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION **9**

Concepts of control systems - open loop and closed loop control systems and their differences - different examples of control systems - classification of control systems, feedback characteristics, effects of feedback. Mathematical models - differential equations, impulse response and transfer functions.

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UNIT II TRANSFER FUNCTION REPRESENTATION 9

Block diagram representation of systems considering electrical systems as examples - block diagram algebra - representation by signal flow graph - reduction using mason's gain formula.

UNIT III TIME RESPONSE ANALYSIS 9

Standard test signals - time response of first order systems - characteristic equation of feedback control systems, transient response of second order systems - time domain specifications - steady state response-steady state errors and error constants - effects of proportional derivative, proportional integral systems, PID controllers

UNIT IV STABILITY AND FREQUENCY RESPONSE ANALYSIS 9

The concept of stability routh's stability criterion - The root locus concept – construction of root loci-effects of adding poles and zeros to G(S) H(S) on the root loci - Frequency domain specifications - bode diagrams - determination of frequency domain specifications and transfer function from the bode diagram - phase margin and gain margin-stability analysis from bode plots. Polar plots.

UNIT V STATE SPACE ANALYSIS 9

Concepts of state - state variables and state model - derivation of state models from block diagrams – diagonalization - solving the time invariant state equations - state transition matrix and it's properties - concepts of controllability and observability.

Total : 45 Hours

Textbooks:

T1. Rai, G.D., "Non-Conventional Energy Sources", Khanna Publishers, Sixth Edition 2017.

T2. Khan, B.H, Non-Conventional Energy Resources", Mc. Graw Hill Education Ltd, third reprint 2017

Reference Books:

R1. Rao S. Paruklekar, B.B, "Energy Technology – Non Conventional, Renewable and Conventional", Khanna Publishers,1994

R2. John Twidell and Tony Weir, "Renewable Energy Resources", Taylor and Francis Publications, Third edition, 2015.

R3. Mukund R.Patel, "Wind and Solar Power Systems", CRC Press LLC.

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U19FTOE001	FOOD SCIENCE AND NUTRITION	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To Explain the basic concepts of food and nutrition.
- To Define the overall classification, function, and source of carbohydrates, lipids and proteins.
- To Discuss the overall aspects of vitamins.
- To Outline the role of health and nutritional importance of micro and macro minerals.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Discuss the basics in the area of nutritional assessment in health and disease and to categorize the recommended dietary allowances for different age groups.

CO2 : Express the classifications, functions and sources of carbohydrates, lipids and proteins.

CO3 : List the various attributes of fat- and water-soluble vitamins.

CO4 : Report the role, bioavailability, sources and deficiency diseases of macro and micro minerals.

CO5 : Recognize the diets and concepts of foods suggested for nutritional, chronic and acute disorders.

CO6 : Classify and to analyse the different techniques of qualitative and quantitative analysis.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	3	-	-	-	-	-	-	-	-	-	1	-
CO3	1	3	-	-	3	-	-	2	-	-	-	-	-	-	1
CO4	1	-	-	-	3	-	-	2	-	-	-	-	-	-	1
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I HUMAN NUTRITION **9**

Historical perspective of nutrient requirements – Assessment of nutritional status – recommended dietary allowances of macronutrients for all age groups – Assessment of protein quality – Malnutrition and related disorders – Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNIT II BIOMOLECULES **9**

Carbohydrates - Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Refined & Hydrogenated fats process. Proteins – Definitions, Classification, Function, Amino Acids, Sources of Proteins.

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UNIT III VITAMINS 9

Physiological role, bio-availability, requirements, sources and deficiency of Fat Soluble Vitamins: Vitamin A, Vitamin D, E & K. Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6.

UNIT IV MINERALS 9

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride.

UNIT V RECENT TRENDS IN DIETETICS 9

Principles of dietary management in gout, rheumatism, AIDS/HIV – Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods, health foods and novel foods, organically grown foods, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

Total : 45 Hours

Textbooks:

T1. Gordon M. Wardlaw. Perspectives in Nutrition. WCB McGraw-Hill Publishers, Boston, 9th Edition. 2013.

T2. Shubhangini A. Joshi. Nutrition and Dietetics. Tata Mc Grow- Hill publishing Company Ltd, New Delhi. 4th Edition. 2016

T3. Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6th Edition. 2017

Reference Books:

R1. Ronald Ross Watson. Functional foods and Nutraceuticals in Cancer Prevention. Ed. Wiley – Blackwell. 2003

R2. Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2018..

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U19FTOE002	FOOD PRESERVATION TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To introduce the students to the area of Food Processing and preservation.
- To have an effective understanding of food processing and technology subjects.
- To enable students to appreciate the importance of food processing with respect to the large-scale production.
- To import knowledge on processing of food waste.

Course Outcomes:

At the end of the course students will be able to,

CO1: Describe the fundamentals of food processing and preservation.

CO2: Familiar with the functional properties of Carbohydrates, fats, lipids, proteins in food.

CO3: Knowledge about the importance of food additives and their function and will develop strategies that will promote food safety and prevent food borne illness.

CO4: Analyze the uses of enzymes, modified proteins and develop novel products, explain, analyze and evaluate scenarios related to various unit operations in food processing and preservation.

CO5: Identify spoilage and deterioration mechanism in food and methods to control deterioration and spoilage.

CO6: Demonstrate packing methods, materials and factors affecting food packing.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	2	-	3	-	-	-	-	-	-	-	-	-	3	-	2
CO4	3	3	2	-	-	-	-	-	-	-	3	-	-	2	-
CO5	-	3	2	-	-	-	-	-	-	-	3	-	-	2	-
CO6	3	2	2	2	2	1	2	-	-	-	-	-	-	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE 9

Source of food - significance for processing and preservation of foods – Different food groups-, food pyramids, classification and functions, cooking of foods – methods and cooking media, advantages of processing of foods, changes of nutritional components in cooking, effects of processing of foods on anti-nutritional components.

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UNIT II FOOD COMPONENTS **9**

Classification - Structure, nutritive value, processing outlines of major Cereals and millets – Pulses - fruits and vegetables, fats, oilseeds and nuts. Major and minor nutrients - sugar and related products, spices and aromatics, beverages and appetizers, organic foods.

UNIT III PROCESSING OF ANIMAL FOODS **9**

Meat, Poultry and Fish - Structure, composition, nutritive value and processing outline. Processing of milk and milk products, egg processing and storage, need and nutritional benefits of animal products, value added products

UNIT IV INTRODUCTION TO FOOD PROCESSING AND PRESERVATION **9**

Food spoilage, fermentation, methods of preservation - High temperature and Low temperature Preservation, traditional methods of food processing and preservation, radiation processing, microwave, non-thermal techniques. Role of enzymes and additives in food preservation

UNIT V FOOD PACKAGING AND QUALITY **9**

Food packaging – importance, types and functions, packaging materials – synthetic and natural, Impact of packaging materials on food quality, shelf-life of foods, bottling and canning, nutritional labelling, labelling of vegan and animal based products

Total : 45 Hours

Textbooks:

T1. Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge, 2003.

T2. Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.

Reference Books:

R1. Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005

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U19ITOE001	UI AND UX DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype.

Course Outcomes:

At the end of the course students will be able to,

CO1: Understand the principles of UI and UX design, including user centered design, information architecture, visual hierarchy, and usability testing.

CO2: Build UI for user Applications

CO3: Evaluate UX design of any product or application

CO4: Demonstrate UX Skills in product development

CO5: Implement Sketching principles

CO6: Create Wireframe and Prototype

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	2	-	-	-	3	-	2	2	3	3	2
CO2	3	2	3	-	2	-	-	-	3	-	2	2	3	3	2
CO3	3	2	3	-	2	-	-	-	3	-	2	2	3	3	2
CO4	3	2	3	-	2	-	-	-	3	-	2	2	3	3	2
CO5	3	2	3	-	2	-	-	-	3	-	2	2	3	3	2
CO6	3	2	3	-	2	-	-	-	3	-	2	2	3	3	2

UNIT I FOUNDATIONS OF DESIGN 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides 126.

UNIT III FOUNDATION OF UX DESIGN 9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

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UNIT IV **WIREFRAMING, PROTOTYPING AND TESTING** **9**

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wire flows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

UNIT V **RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE** **9**

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.

Total : 45 Hours

Textbooks:

T1. Joel Marsh, “UX for Beginners”, O’Reilly, 2022.

T2. Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021.

T3. Ralf Steinmetz, Klara Nahrstedt, “Multimedia Systems”, Springer IE, 2004.

Reference Books:

R1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3rd Edition , O’Reilly 2020.

R2. Steve Schoger, Adam Wathan “Refactoring UI”, 2018

R3. Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile”, 3rd Edition, 2015.

R4. https://www.nngroup.com/articles/

R5. https://www.interaction-design.org/literature

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U19ITOE002	MULTIMEDIA SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To enrich student learning in multimedia systems.
- To train the students to acquire knowledge in multimedia related technologies.
- To acquire knowledge about multimedia techniques to enhance quality of service.
- To acquire knowledge on multimedia architecture.
- To learn about the multimedia elements in a comprehensive way.

Course Outcomes:

At the end of the course students will be able to,

CO1: Handle the multimedia elements effectively.

CO2: Encode and decode the multimedia elements.

CO3: Understand the underlying multimedia computing architectures used for media development.

CO4: Develop effective strategies to deliver Quality-of-Experience in multimedia applications.

CO5: Design and implement algorithms and techniques related to multimedia objects**.**

CO6: Design and develop multimedia applications in various domains.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	3	2	2	-	-	3	2	-	2	-	3
CO2	3	2	3	-	3	2	2	-	-	3	2	-	2	-	3
CO3	3	2	3	-	3	2	2	-	-	3	2	-	2	-	3
CO4	3	2	3	-	3	2	2	-	-	3	2	-	2	-	3
CO5	3	2	3	-	3	2	2	-	-	3	2	-	2	-	3
CO6	3	2	3	-	3	2	2	-	-	3	2	-	2	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO MULTIMEDIA ELEMENTS 9

Multimedia – Medium – Properties of a Multimedia System – Traditional Data Stream Characteristics – Data Stream Characteristics of Continuous Media – Basic Sound Concepts – Speech – Images and Graphics – Computer Image Processing – Video and Animation – Computer Based Animation.

UNIT II MULTIMEDIA COMPRESSION 9

Storage Space – Coding Requirements – Hybrid Coding – JPEG: Image Preparation, Lossy Mode, Lossless Mode, Hierarchical Mode – H.261 – MPEG: Video Encoding, Audio Encoding, Data Stream, MPEG 3, MPEG 7, MPEG 21 – DVI – Audio Encoding.

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UNIT III MULTIMEDIA ARCHITECTURES 9

User Interfaces – OS multimedia support – Multimedia Extensions – Hardware Support – Distributed multimedia applications – Real time protocols – Play back Architectures – Synchronization – Document and document architecture – Hypermedia concepts – Hypermedia design – Digital copyrights – Digital Library – Multimedia Archives.

UNIT IV MULTIMEDIA OPERATING SYSTEM AND DATABASES 9

Real Time – Resource Management – Process Management – File systems – Interprocess communication and synchronization – Memory management – Device Management – Characteristics of MDBMS – Data Analysis – Data structures – Operations on data – Integration in a database model.

UNIT V MULTIMEDIA COMMUNICATION &APPLICATIONS 9

Tele Services – Implementation of Conversational Services, Messaging Services, Retrieval Services, Tele Action Services, Tele Operation Services – Media Consumption – Media Entertainment – Virtual Reality – Interactive Audio – Interactive Video – Games.

Total : 45 Hours

Textbooks:

T1. Ralf Steinmetz, Klara Nahrstedt, "Multimedia computing, communications, and applications", Pearson India, 2009.

T2. Ranjan Parekh, "Principles of Multimedia", Second Edition, McGraw Hill Education, 2017.

T3. Ralf Steinmetz, Klara Nahrstedt, "Multimedia Systems", Springer IE, 2004

Reference Books:

R1. Tay Vaughan, "Multimedia: Making it Work", McGraw – Hill Education, Ninth Edition, 2014

R2. Mark S Drew, Zee Nian Li, "Fundamentals of multimedia", Prentice Hall, 2006

R3. Jerry D. Gibson, Toby Berger, Tom Lookabaugh, Dave Lindergh, Richard L. "Baker Digital Compression for Multimedia: Principles and Standards", Elsevier, 2006.

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U19MEOE001	ENGINEERING DRAWING	L	T	P	C
		3	0	0	3

Course Objectives:

- To have the knowledge of interpretation of dimensions of different quadrant projections.
- To understand the basic principles of engineering drawing.
- To have the knowledge of generating the pictorial views.
- To understand the development of surfaces.

Course Outcomes:

At the end of the course students will be able to,

CO1: Prepare and understand drawings.
CO2: Identify various D curves used in Engineering Drawing and their applications.
CO3: Use the principles of orthographic projections.
CO4: By studying about projections of solids students will be able to visualize three dimensional objects and that will enable them to design new products.
CO5: Design and fabricate surfaces of different shapes**.**
CO6 : Represent the objects in three dimensional appearances.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	1	-	-	-	1	-
CO3	3	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	3	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO6	3	-	1	-	-	-	-	-	-	3	-	-	-	1	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO ENGINEERING DRAWING 9

Principles of engineering graphics and their significance – drawing instruments and their use – conventions in drawing – lettering – BIS conventions. Dimensioning rules, geometrical construction of curves used in Engineering Practise: Conic Sections, Special Curves - Cycloids, Epicycloids, and Hypocycloids.

UNIT II ORTHOGRAPHIC PROJECTION IN FIRST ANGLE PROJECTION ONLY 9

Principles of orthographic projections – conventions – first and third angle projections. Projections of points and lines inclined to both the planes.

UNIT III PROJECTIONS OF PLANES AND SOLIDS 9

Projections of regular planes - inclined to both planes. Projections of regular solids inclined to both planes.

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UNIT IV DEVELOPMENT OF SURFACES 9

Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts.

UNIT V ISOMETRIC PROJECTIONS 9

Principles of Isometric Projections-Isometric Scale- Isometric Views-Conventions-Plane Figures, Simple and Compound Solids. Transformations of projection: Conversion of isometric Views to Orthographic Views. Conversion of orthographic views to isometric projections vice-versa

Total : 45 Hours

Textbooks:

T1. Basant Agarwal, "Engineering Drawing", TMH.

T2. Jolhe, Dhananjay, "Engineering Drawing: With an Introduction to CAD", Tata McGraw Hill, India. 2006.

Reference Books:

R1. N. D. Bhat, "Engineering Drawing" Charotar Publications, New Delhi., 2006

R2. Trymbaka Murthy, "Computer Aided Engineering Drawing", I.K. International Publishers, 2007

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U19MEOE002 MODERN MANUFACTURING TECHNIQUES

L	T	P	C
3	0	0	3

Course Objectives:

- To make acquainted the various unconventional manufacturing processes.
- To know about the applications of advanced manufacturing processes.
- To encourage the students for developing the models of Advanced Manufacturing Processes.

Course Outcomes:

At the end of the course students will be able to,

CO1: Conversant with the advanced machining process and to appreciate the effect of process parameters on the surface integrity aspects during the advanced machining process.

CO2: Select appropriate advanced manufacturing Processes as per row materials and surface finish

CO3: Categorize the various non traditional material removal process based on energy sources and mechanism employed.

CO4: Analyze the processes and evaluate the role of each process parameter during micro machining of various advanced material removal processes.

CO5: Explain the processes used in additive manufacturing for a range of materials and applications.

CO6 : Identify the types of composite material characteristics, types of micro & macro machining processes

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	-	-	-	-	-	2	-	-	-
CO2	2	-	2	-	3	-	-	-	-	-	-	-	-	1	-
CO3	2	-	-	-	2	-	-	-	-	-	-	2	-	-	-
CO4	2	3	-	-	2	-	-	-	-	-	-	-	-	-	2
CO5	2	-	-	3	2	-	-	-	-	-	2	-	-	-	-
CO6	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I SURFACE TREATMENT **9**

Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT II NON-TRADITIONAL MACHINING **9**

Introduction, need, AJM, Parametric Analysis, Process capabilities, USM –Mechanics of cutting, models, Parametric Analysis, WJM –principle, equipment, process characteristics, performance, EDM – principles, equipment, generators, analysis of R-C circuits, MRR, Surface finish, WEDM.

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UNIT III GLASS SCIENCE 9

Glass and Glassy State, Glass Compositions and Properties, Raw Materials, Glass Melting, glass furnace and furnace types, Glass Forming Processes, Glass processing, Application of Glass.

UNIT IV CERAMICS AND COMPOSITE 9

Processing of ceramics: Applications, characteristics, classification. Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics. Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT V MICROELECTRONIC DEVICES 9

Fabrication of Microelectronic devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology, micromachining and High-speed Machining, basic principles, working, applications, advantages.

Total : 45 Hours

Textbooks:

T1. Kalpakijian , "Manufacturing Engineering and Technology", Addison Wesley, 1995

T2. V. K. Jain , "Advanced Machining Processes", Allied Publications.

Reference Books:

R1. R. A. Lindburg , "Process and Materials of Manufacturing", 4th edition, PHI 1990.

R2. John A Schey , "Introduction to Manufacturing Processes", Tata Mc Graw Hill.

R3. J. Mc Geough , "Micro Machining of Engineering Materials", CRC Press.

R4. . A Mc Geough , "Advanced Methods of Machining" , Springer.

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U19PHOE001	NANOTECHNOLOGY AND ENGINEERING APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To introduce the concept of nanotechnology and understand the importance of nanotechnology
- To give deep insight into fabrication and characterization techniques for nanostructures
- To provide an overview of the wide applications of nanotechnology in various technological fields.

Course Outcomes:

At the end of the course students will be able to,

CO1: Understand the basic concepts of nanotechnology.

CO2: Gain basic knowledge on various synthesis and techniques involved in preparation of nanomaterials.

CO3: Understand the general types and different classes of Nanomaterials

CO4: Apply the knowledge on different properties of Nanomaterials and selection of material for the specific purpose of application

CO5: Understand and apply the knowledge of different characterization tools and characterization of Nanomaterials.

CO6 : Apply the basic knowledge about the wide applications of nanotechnology in various technological fields.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION AND SYNTHESIS OF NANOMATERIALS 9

Introduction to nanotechnology – definition, invention, building blocks of nanotechnology, chemical bonds - Van der Waals Interactions, Dipole-Dipole interactions, Microstructure and Defects in Nanocrystalline Materials – dislocations, twins, stacking points and voids; grain boundaries, triple junctions and disclinations. Synthesis of nanomaterials**:** Bottom – Up Approaches: physical vapour deposition (PVD), chemical vapour deposition (CVD), spray pyrolysis. Top- Down Approaches: Mechanical alloying, high pressure torsion (HPT).

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UNIT II TYPES OF NANOMATERIALS 9

Carbon Nanotubes (CNT): Introduction, classification of CNT'S, synthesis and physical properties of CNT (Electrical, Transport, Mechanical), applications. Fullerenes: Introduction, synthesis and purification, physical properties, applications. Semiconductor Quantum dots: Introduction, synthesis of Quantum dots, physical and chemical properties, applications. Nanocomposites: Introduction, synthesis and processing of Inorganic nanotubes and polymeric nanocomposites, applications. Nanowires: Introduction, physical properties of nanowires – (structural, Optical, Chemical), Applications.

UNIT III PROPERTIES OF NANOMATERIALS 9

Mechanical Properties: Introduction, Grain Size Effect, Creep, Hardness, Fracture Strength, Strengthening and Toughening Mechanisms, Crack Healing (Annealing Treatment). Electrical and Optical properties: Electrical conduction and tunnelling conduction in nanoparticles, electronic conduction with nanoparticles (AC Conductivity & DC Conductivity). Optical properties: Transmission, Absorption, Reflection in nanoparticles, optical constants (Absorption coefficient, extinction coefficient and Refractive index).

UNIT IV CHARACTERIZATION TOOLS 9

XRD (X-Ray diffraction), SAXS (Small Angle X-ray Emission Spectroscopy), SEM (Scanning Electron Microscopy), TEM (Transmission Electron Microscopy), STM (Scanning Tunnelling Microscopy), AFM (Atomic Force Microscopy).

UNIT V APPLICATIONS OF NANOTECHNOLOGY 9

Electrical and electronic applications: MEMS (Micro Electro Mechanical Systems), NEMS (Nano Electro Mechanical Systems), Nanosensors, nanolithography. Nanotechnology for Renewable Energy: Hydrogen energy, fuel cell technology, wind and solar energy. Nanotechnology for information technology and Data Storage applications.

Total : 45 Hours

Textbooks:

T1. Köhler, Michael, and Wolfgang Fritzsche. Nanotechnology, "An Introduction to Nano structuring Techniques" 2nd ed. Wiley.

T2. Pradeep, "Nano: The Essentials - Understanding Nano Science and Nano Technology", McGraw-Hill

T3. A. K. Bandyopadhyay, "Nano Materials", New Age International Publishers

T4. M. H. Fulekar, "Nanotechnology - Importance and applications". I.K. International publishing house pvt. Ltd.

Reference Books:

R1. S. Murty, P. Shankar, Baldev Raj, James Murday, "Textbook of Nanoscience and Nanotechnology", Springer Berlin Heidelberg.

R2. B. Bhushan, Springer Handbook of Nano Technology.

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U19ENOE001	ENGLISH FOR COMPETITVE EXAMS (Common to all)	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To prepare learners to face the challenges of regular/online competitive exams the English language globally.
- To enable students to prepare for competitive exams of various kinds especially meant for testing ability in the English language.
- To introduce students to the common question types asked in competitive examinations concerning English- grammar, vocabulary, comprehension, and other significant topics.
- To help the students to overcome the fear of English as a compulsory subject in various competitive exams.
- To encourage students to appear and prepare for the competitive exams.

Course Outcomes:

At the end of the course students will be able to,

CO1: Confidently use the English language at an advanced level sharing their points of view with effective conclusions.

CO2: Construct correct sentences with the advanced vocabulary of the fields like Banking, Indian polity, Education, Corporate, etc.

CO3: Read accurately using contextual, analytical thinking and logical thinking skills

CO4: Aware of the opportunities available in the government and private sectors

CO5: Demonstrate excellent Time Management skills with regard to various competitive exam patterns.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	2	2	2	3	-	2	-	-	2
CO2	-	-	-	-	-	-	-	1	2	3	-	2	-	-	2
CO3	-	-	-	-	-	2	-	2	3	3	-	2	-	-	2
CO4	-	-	-	-	-	-	3	2	1	3	-	3	-	-	3
CO5	-	-	-	-	-	3	3	3	3	3	-	3	-	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I **9**

Types of Sentences - Sentence correction -Sentence sequence –Word Reordering - Data Interpretation: Tree Diagram, Flow Chart, Table, Line Graph – Discourse Markers – Identifying the exams interested to appear for - Online Course: Udemy, Edx, Future Learn.

UNIT II **9**

Reading Comprehension: Focus on different levels of Comprehension- Literal, Inferential, Analytical, and Critical reasoning – Identifying keywords and signal words, decoding the building blocks of a

passage, understanding the jargon and double distractors – Error Spotting Rules - Identification Common Errors

UNIT III **9**

Listening Comprehension: Micro skills and Macro skills of Listening – Idioms and Phrases- Homonyms and Homophones – Collocations- Synonyms and Antonyms: Banking, Indian Constitution, Education, Corporate, and Higher Education - Para jumbles

UNIT IV **9**

Speaking: Presentation and Public: Record of videos – Verbal Ability; Sentence Completion, and Verbal analogies –Confirmation of registering for competitive exams.

UNIT V **9**

Speech Project – Time Management – Stress Management – Standard Assessment: 5 Mock Tests

Total : 45 Hours

Textbooks:

T1. Richards, C. Jack. Interchange Students Book-3 New Delhi: CUP, 2015.

T2. Means,L. Thomas and Elaine Langlois. English and Communication For Colleges. Cengage Learning, USA: 2007

T3. The Official Guide to the GRE General Test, Third Edition (TEST PREP) by Educational Testing Service | 16 February 2017

T4. The Yearly Current Affairs 2022 for Competitive Exams (Upsc, State Psc, Ssc, Bank Po/ Clerk, Bba, MBA, Rrb, Nda, Cds, Capf, Crpf), Disha Publication.

Reference Books:

R1. Brians, Paul. (2013). Common errors in English usage: Third edition. Wilsonville: Franklin, Beedle & Associates Inc

R2. Harrison, Louis. (2009). Achieve IELTS grammar and vocabulary: English for international education. London: Cengage Learning EMEA.

R3. Khashoggi, K., & Astuni.A. (2014) SAT reading comprehension workbook:Advanced practice series. New York: Ilex Publications

R4. Prasad, Hari Mohan. (2013). Objective English for competitive exams. New Delhi:Tata McGraw-Hill Education India.

R5. Seely, John. (2013). Oxford guide to effective writing and speaking: How tocommunicate clearly. Oxford: Oxford University Press.

Web Resources:

W1 https://www.edubull.com/exams/competitive-exams

W2 https://sscstudy.com/

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OPEN ELECTIVE – II

U19AEOE003	INTRODUCTION TO BIO ENERGY	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To introduce to the students the concepts of bio energy resources
- To expose the students to types of energy resources
- To enhance knowledge on estimation of bio energy plants.
- To expose the students to bio fuel production.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand the importance of bio resources
CO2 : classify the bio energy and characteristics of bio energy.
CO3 : Knowledge in bio reactors and fermenters.
CO4 : gain knowledge in Alcohol production process
CO5 : Understand the importance of Energy and Environment.
CO6 : Knowledge in capturing and applying bioenergy on replacement of fossil fuels.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	2	2	-	-	-	-	-	2	2	3
CO2	3	2	-	-	-	2	2	-	-	-	-	-	3	3	3
CO3	3	2	-	-	-	2	2	-	-	-	-	-	2	2	3
CO4	3	2	-	-	-	2	2	-	-	-	-	-	2	2	3
CO5	3	2	-	-	-	2	2	-	-	-	-	-	3	3	3
CO6	3	2	-	-	-	2	2	-	-	-	-	-	2	2	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I BIO RESOURCE - AN INTRODUCTION 9

Bio resource – origin – biomass types and characteristics - biomass conversion technology - Biodegradation - steps in biogas production - parameters affecting gas production - Types of biogas plants - Construction details - operation and maintenance.

UNIT II BIO ENERGY 9

Slurry handling- enrichment and utilization – Biogas appliances- Biochemical characteristics of bio resources- Bioenergetics – Biocatalysis – Kinetics of product formation.

UNIT III BIO REACTORS AND FERMENTORS 9

Bio reactors/ fermentors – Batch type – continuous stirred tank reactors- Biological waste water treatment - Activated sludge process - Down stream processing - Recovery and purification of products.

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UNIT IV ALCOHOL PRODUCTION 9

Alcohol ethanol production - Acid hydrolysis - enzyme hydrolysis-Methanol synthesis - Antibiotics - enzymes - principles of thermochemical conversion – combustion - pyrolysis-Gasification – types of gasifiers

UNIT V ENERGY AND ENVIRONMENT 9

Principles of operation - chemical reaction - cleaning and cooling - Utilization- Improved wood burning stove - Energy plantations - Biomass briquetting - cogeneration- Impact on Environment – Bioenergy policy.

Total : 45 Hours

Text books:

T1. Rai G.D, "Non conventional sources of Energy", Khanna publishers, New Delhi, 1995.

T2. S Bouley James .E & David Follis, "Biochemical Engineering Fundamentals", Tata Mc Graw-Hill publishing company, Tokyo.1986.

Reference Books:

R1. Chawla O.P, "Advances in Biogas Technology", ICAR publication New Delhi 1986.

R2. Khandelwal K.C. and Mahdi, S.S. 1986 "Biogas Technology" Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.

R3. Srivastava, P.K., Shukla, B.D. and Ojha, T.P. 1993. "Technology and application of biogas" Jain Brothers, New Delhi

R4. Mathur,A.N.and Rathore,N.S., "Biogas production Management and Utilisation". Himanshu Publication. New Delhi

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U19AEOE004	ROBOTICS IN AGRICULTURE	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To introduce the overview of robotic systems and their dynamics
- To impart knowledge on system stability
- To acquire knowledge on joint space and task space control schemes
- To understand the concept of nonlinear control and observer schemes

Course Outcomes:

At the end of the course students will be able to,

CO1 : Understand basic concept of robotic systems and their dynamics

CO2 : Analyze system stability and types of stability.

CO3 : Know about joint space and task space control schemes.

CO4 : Understand the concept of nonlinear control and observer schemes

CO5 : Gain knowledege on farm management and financial analysis.

CO6 : Familiarize with budgeting and cost estimation for farm layout.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO6	2	3	2	1	-	-	-	-	-	-	-	-	-	1	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION AND OVERVIEW OF ROBOTIC SYSTEMS AND THEIR DYNAMICS **9**

Forward and inverse dynamics - Properties of the dynamic model and case studies - Introduction to nonlinear systems and control schemes.

UNIT II SYSTEM STABILITY AND TYPES OF STABILITY **9**

Lyapunov stability analysis, both direct and indirect methods. Lemmas and theorems related to stability analysis.

UNIT III JOINT SPACE AND TASK SPACE CONTROL SCHEMES **9**

Position control - velocity control - trajectory control and force control.

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UNIT IV NONLINEAR CONTROL SCHEMES **9**

Proportional and derivative control with gravity compensation - computed torque control - sliding mode control - adaptive control - observer based control - robust control and optimal control

UNIT V NONLINEAR OBSERVER SCHEMES **9**

Design based on acceleration - velocity and position feedback - Numerical simulations using - software packages namely MATLAB/MATHEMATICA.

Total : 45 Hours

Text books:

T1. R Kelly, D. Santibanez, LP Victor and Julio Antonio, "Control of Robot Manipulators in Joint Space", Springer, 2005.

T2. A Sabanovic and K Ohnishi, "Motion Control Systems", John Wiley & Sons (Asia), 2011.

Reference Books:

R1. R M Murray, Z. Li and SS Sastry, "A Mathematical Introduction to Robotic Manipulation", CRC Press, 1994.

R2. J J Craig, "Introduction to Robotics: Mechanics and Control', Prentice Hall, 4th Ed, 2018.

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U19BTOE003	ANALYTICAL METHODS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To inculcate the entrepreneurship spark among the student community by converting their research ideas into commercial products.
- To develop the entrepreneurial skill in the field of biotechnology.
- To study the Business strategy and Technology Transfer.

Course Outcomes:

At the end of the course students will be able to,

CO1: Learn the different bio potential and its propagation.

CO2: Get Familiarize the different electrode placement for various physiological recording.

CO3: Design bio amplifier for various physiological recording.

CO4: Understand various technique non electrical physiological measurements.

CO5: Understand the different biochemical measurements.

CO6: Characterize and analyse various macromolecules.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	2	-	-	-	-	-	-	-	-	-	2	-
CO2	3	1	2	1	-	1	-	-	-	-	-	-	1	2	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	1	1	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	3	-	-	3	-	-	-	-	-	-	-	-	-
CO6	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I SPECTROMETRY **9**

Properties of electromagnetic radiation- wave properties – components of optical instruments-Sources of radiation – wavelength selectors – sample containers – radiation transducers -Signal process and read outs – signal to noise ratio – sources of noise – Enhancement of signal to noise – types of optical instruments – Applications.

UNIT II MOLECULAR SPECTROSCOPY **9**

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance – Beers law – Instrumentation – Applications -Theory of fluorescence and Phosphorescence – Instrumentation – Applications – Theory of Infrared absorption spectrometry – IR instrumentation – Applications - Theory of Raman spectroscopy – Instrumentation – applications.

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UNIT III NMR AND MASS SPECTROMETRY 9

Theory of NMR — chemical shift- NMR-spectrometers – applications of 1H and 13C NMR-Molecular mass spectra – ion sources. Mass spectrometer. Applications of molecular mass -Electron paramagnetic resonance- g values – instrumentation.

UNIT IV SEPARATION METHODS 9

General description of chromatography – Band broadening and optimization of column performance- Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography -size exclusion chromatography - Affinity chromatography principles of GC and applications – HPLC - Capillary electrophoresis – Applications.

UNIT V ELECTRO ANALYSIS AND SURFAVE MICROSCOPY 9

Electrochemical cells- Electrode potential cell potentials – potentiometry- reference electrode – ion selective and molecular selective electrodes – Instrument for potentiometric studies – Voltametry - Cyclic and pulse voltametry- Applications of voltametry . Study of surfaces – Scanning probe microscopes – AFM and STM.

Total : 45 Hours

Text books:

T1. Skoog, D.A. F. James Holler, and Stanky, R., "Crouch Instrumental Methods of Analysis". Cengage Learning , 2007.

T2. Willard, Hobart, etal., "Instrumental Methods of Analysis". 7th Edition, CBS, 1986.

T3. Haven, Mary C., etal., "Laboratory Instrumentation" 4th Edition, John Wiley, 1995

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U19BTOE004	INDUSTRIAL WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To emphasize on the importance of waste management in the industries.

Course Outcomes:

At the end of the course students will be able to,

CO1: Design biological treatment units.
CO2: Undertake projects on biological wastewater treatment.
CO3: Design the treatment plants with fundamental understanding.
CO4: Be familiar with sampling of wastes.
CO5: The students will undertake projects related to waste management.
CO6: Understand various case studies related to waste management.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	2	2	-	1	3	-	-	-	-	2	-
CO4	3	1	1	-	-	1	-	1	-	-	-	-	-	1	-
CO5	3	3	2	1	2	-	-	1	-	-	-	-	-	1	-
CO6	3	3	2	1	2	-	-	1	-	-	-	-	-	1	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO WASTE MANAGEMENT 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.

UNIT II CLEANER PRODUCTION 9

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and by product recovery – Applications.

UNIT III POLLUTION FROM MAJOR INDUSTRIES 9

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concept.

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UNIT IV REACTORS USED IN WASTE WATER TREATMENT 9

Theory: Modeling of Ideal Attached Growth Reactors, Bio-film Modeling Aerobic Growth of Biomass in PackedTowers, Aerobic Growth of Heterotrophs in Rotating Disc Reactors, Fluidized Bed Biological Reactors.

UNIT V CASE STUDIES 9

Industrial manufacturing process description, Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries - Textiles - Pulp and Paper Metal finishing – Sugar and Distilleries.

Total : 45 Hours

Text books:

T1. Bhatia, "Handbook of Industrial Pollution and Control", Volume I and II, CBS Publishers, New Delhi, 2003.

T2. Mahajan, S.P. "Pollution Control in Process Industries", Tata McGraw Hill Publishing Co., New Delhi, 1991.

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U19BMOE003 **HOSPITAL MANAGEMENT SYSTEM**

L	T	P	C
3	0	0	3

Course Objectives:

This course aims,

- To understand the fundamentals of hospital administration and management.
- To know the market related research process
- To explore various information management systems and relative supportive services.
- To learn the quality and safety aspects in hospital.

Course Outcomes:

At the end of the course students will be able to,

CO1: Explain the principles of Hospital administration.
CO2: Identify the importance of Human resource management.
CO3: List various marketing research techniques.
CO4: Identify Information management systems and its uses.
CO5: Understand safety procedures followed in hospitals
CO6: Analyze the quality and safety aspects in hospital.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	1	2	-	-	-	1	-	2	2	3
CO2	2	3	3	3	-	1	3	-	-	-	1	-	3	2	2
CO3	2	3	3	3	-	1	3	-	-	-	1	-	3	3	2
CO4	3	2	3	3	-	1	2	-	-	-	1	-	2	3	3
CO5	2	2	3	3	-	1	2	-	-	-	1	-	2	2	2
CO6	2	2	3	3	-	1	2	-	-	-	1	-	2	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I **OVERVIEW OF HOSPITAL ADMINISTRATION** **9**

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio-Medical Waste Management.

UNIT II **HUMAN RESOURCE MANAGEMENT IN HOSPITAL** **9**

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

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UNIT III MARKETING RESEARCH PROCESS 9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES 9

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department –Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL 9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

Total : 45 Hours

Text books:

T1. R.C.Goyal, "Hospital Administration and Human Resource Management", PHI 4th Edition, 2006.

T2. G.D.Kunders, "Hospitals – Facilities Planning and Management' TMH, New Delhi 5th edition Reprint 2007.

Reference books:

R1. Cesar A.Caceres and Albert Zara, "The Practice of Clinical Engineering", Academic Press, New York, 1977

R2. Norman Metzger, "Handbook of Health Care Human Resources Management", 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.

R3. Peter Berman, "Health Sector Reform in Developing Countries" Harvard University Press, 1995.

R4. William A. Reinke, "Health Planning For Effective Management" Oxford University Press.1988.

R5. Blane, David, Brunner, "Health and Social Organization: Towards a Health Policy for the 21st Century", Eric Calrendon Press 2002.

R6. Arnold D. Kalcizony & Stephen M. Shortell, "Health Care Management", 6th Edition Cengage Learning, 2011

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U19BMOE004 **BIOMEDICAL INSTRUMENTATION**

L	T	P	C
3	0	0	3

Course Objectives:

This course aims,

- To impart knowledge of the principle of operation and design of sensory equipment's.
- To render a broad and modern account of neurological, muscular, cardiological and respiratory instruments.
- To introduce idea about instrumentation in patient care and diagnosis.

Course Outcomes:

At the end of the course students will be able to,

CO1: Explain the principles of Hospital administration.

CO2: Identify the importance of Human resource management.

CO3: List various marketing research techniques.

CO4: Identify Information management systems and its uses.

CO5: Understand safety procedures followed in hospitals.

CO6: Analyze the quality and safety aspects in hospital.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	-	-	-	-	2	2	3	3	2
CO2	2	2	2	2	2	2	-	-	-	-	2	2	3	3	2
CO3	3	3	2	3	2	1	-	-	-	-	2	2	2	2	3
CO4	3	3	3	2	2	2	-	-	-	-	2	2	2	2	3
CO5	2	2	2	3	2	1	-	-	-	-	2	2	2	2	2
CO6	2	2	2	2	2	1	-	-	-	-	2	2	2	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I **RECORDING OF BIOSIGNALS** **9**

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, Lead configuration, 12 lead ECG machine circuit, common mode and interference reduction circuits, Vector cardiograph EEG – 10-20 electrode system. EMG – Recording, Electro encephalogram, Magneto encephalogram, EOG & ERG: origin, measurement of EOG, electroretinogram

UNIT II **SENSORY INSTRUMENTATION** **9**

Psychophysiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Hearing and speech aids: conductive and nervous, hearing aids- Types, constructional and functional characteristics. Cochlear implants- Need, constructional details, speech trainer.

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UNIT III CARDIAC EQUIPMENTS 9

Normal and abnormal ECG waveform, diagnosis interpretation, cardiac pacemaker-external pacemaker, implantable pacemaker, different types of pacemakers, fibrillation, defibrillator, AC defibrillator, DC defibrillator, electrodes, synchronised and unsynchronised types. EEG diagnostic interpretation, recording and analysis of EMG waveforms.

UNIT IV RESPIRATORY MEASUREMENT SYSTEM 9

Instrumentation for measuring the mechanics of breathing – Spirometer -Lung Volume and vital capacity, measurements of residual volume, Pneumotachometer – Airway resistance measurement, Whole body Plethysmograph, Intra-Alveolar and Thoracic pressure measurements, Apnoea Monitor. Types of Ventilators – Pressure, Volume, and Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

UNIT V ADVANCED DEVICES 9

Cardiac pacemakers and modern stimulators, Hemodyalysis ventilators, incubators, drug delivery devices, surgical instruments, Therapeutic application of laser, Neonatal Monitoring.

Total : 45 Hours

Text books:

T1. Siamak Najarian, Javad Dargahi, Ali Abouei Mehrizi, "Artificial Tactile Sensing in Biomedical Engineering", Tata McGraw Hill publication, 2009.

T2. Martin Grunwald, Birkhaeuser Verlag AG, "Human Haptic Perception", Boston Basel Berlin publication, 2008.

Reference books:

R1. Abdulmotaleb El Saddik, Mauricio Orozco, Mohamad Eid, Jongeun Cha, "Haptics Technologies: Bringing touch to multimedia", Springer,2011.

R2. MyerKutz., "Biomedical Engineering and Design Handbook", Vol II, Tata Mac Graw Hill.

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U19CEOE003	REMOTE SENSING AND GIS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Understanding about the basic concepts of remote sensing and analyse satellite imagery and extract the required units.
- Usage of thematic maps for various application.

Course Outcomes:

At the end of the course, students should be able to,

CO1 : Analyse the principles and components of photogrammetry and remote sensing.
CO2 : Gain knowledge on various types of sensors and platforms for satellites.
CO3 : Process of data acquisition of satellite images and their characteristics.
CO4 : Analyse an image visually and digitally with digital image processing techniques.
CO5 : Explain the concepts and fundamentals of GIS.
CO6 : Apply the knowledge of remote sensing and GIS in different civil engineering filed.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	2	3	-	-	-	-	-	-	3	2	2	2
CO2	3	2	-	2	3	-	-	-	-	2	-	3	2	2	3
CO3	3	-	1	3	3	2	1	-	-	-	-	3	2	2	1
CO4	3	2	-	3	3	-	2	-	-	-	-	3	2	2	1
CO5	3	-	-	1	3	-	-	-	-	2	-	3	2	2	1
CO6	3	3	1	3	3	2	2	-	-	3	-	3	2	2	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I REMOTE SENSING 9

Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False colour composite, elements of visual interpretation techniques.

UNIT II REMOTE SENSING PLATFORMS AND SENSORS 9

Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms – IRS, sensors, sensor resolutions, Basics of digital image processing - introduction to digital data, systematic errors and non-systematic errors, Image enhancements, image filtering.

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UNIT III GEOGRAPHIC INFORMATION SYSTEM 9

Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute Data - Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.

UNIT IV DATA MODELS 9

Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data conversion.

UNIT V INTEGRATED APPLICATIONS OF REMOTE SENSING AND GIS 9

Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services and Its Applications.

Total: 45 Hours

Textbooks:

T1. Anji Reddy M., "Remote sensing and Geographical information system", B.S. Publications 2008.

T2. Narayan Panigrahi, "Geographical Information Science", and University Press 2008.

T3. Basudeb Bhatta, "Remote sensing and GIS", Oxford University Press 2011

Reference Books:

R1. Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI, 2006

R2. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Information system", Oxford Publications 2004.

R3. S Kumar, "Basics of remote sensing & GIS", Laxmi publications 2005.

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U19CEOE004	AIR POLLUTION AND CONTROL ENGINEEIRNG	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Knowledge on the principle and design of control of Indoor/ particulate / gaseous air pollutant and its emerging trends.

Course Outcomes:

At the end of the course, students should be able to,

CO1 : Understand the nature and characteristics of air pollutants and basic concepts of air quality management.

CO2 : Understand the type and nature of air pollutants, the behaviour of plumes and relevant meteorological determinants influencing the dispersion of air pollutants.

CO3 : Identify, formulate and solve air and noise pollution problems..

CO4 : Design stacks and particulate air pollution control devices to meet applicable standards.

CO5 : Select control equipment's.

CO6 : Ensure quality, control and preventive measures.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	2	3	3	-	1	-	-	3	2	-	1
CO2	3	2	2	-	3	1	3	-	-	-	-	2	2	1	1
CO3	2	3	2	-	-	3	3	-	-	-	-	2	3	1	-
CO4	2	2	-	-	-	3	3	-	1	-	-	2	3	1	1
CO5	1	1	-	-	3	3	3	-	1	-	-	1	2	-	-
CO6	2	2	-	-	3	3	3	-	-	-	-	2	3	-	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION **9**

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards

UNIT II METEROLOGY **9**

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns - Atmospheric Diffusion Theories – Dispersion models, Plume rise

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UNIT III CONTROL OF PARTICULATE CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle - Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Working principle - absorption, Adsorption, condensation, Incineration, Bio filters – Process control and Monitoring.

UNIT V INDOOR AIR QAULITY MANAGEMENT 9

Sources, types and control of indoor air pollutants, sick building syndrome and building related illness- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

Total: 45 Hours

Textbooks:

T1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science media LLC,2004.

T2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press, Inc 2017.

T3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

Reference Books:

R1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.

R2. Arthur C. Stern, "Air Pollution (Vol. I – Vol. VIII)", Academic Press, 2006.

R3. Wayne T. Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.

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U19ECOE003	CONSUMER ELECTRONICS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To Understand troubleshooting in loudspeakers and Microphones
- To Gain knowledge on television signals and components
- To Gain knowledge on various types of audio recording and playback techniques
- To Understand communication systems
- To Understand principle of working of home appliances

Course Outcomes:

At the end of the course, students should be able to,

CO1 : Troubleshoot different types of microphones and speakers.
CO2 : Maintain audio systems.
CO3 : Analyse composite video signal used in TV transmission
CO4 : Troubleshoot TV Receivers
CO5 : Construct various home appliances.
CO6 : Maintain various home appliances.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO2	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO3	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO4	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO5	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO6	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I LOUDSPEAKERS AND MICROPHONES 9

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

UNIT II TELEVISION STANDARDS AND SYSTEMS 9

Components of a TV system – interlacing – composite video signal. Colour TV – Luminance and Chrominance signal; Monochrome and Colour Picture Tubes - Colour TV systems – NTSC, PAL,SECAM - Components of a Remote Control.

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UNIT III OPTICAL RECORDING AND REPRODUCTION 9

Audio Disc – Processing of the Audio signal – read out from the Disc –Reconstruction of the audio signal – Video Disc – Video disc formats- recording systems – Playback Systems.

UNIT IV TELECOMMUNICATION SYSTEMS 9

Telephone services - telephone networks – switching system principles – PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems.

UNIT V HOME APPLIANCES 9

Basic principle and block diagram of microwave oven - washing machine hardware and software - components of air conditioning and refrigeration systems

Total: 45 Hours

Textbooks:

T1. S.P.Bali, "Consumer Electronics", Pearson Education, 2005.

T2. Gupta. R.G, " Audio Video Systems principles maintenance and trouble shooting", Tata Mcgraw Hill, New Delhi, India, 2010.

Reference Books:

R1. Dhake .A.M, " Television and Video Engineering", Mc graw Hill, New Delhi, India, 2006.

R2. Modern television practice: Transmission, reception and applications, New age International, New Delhi, 2015.

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U19ECOE004	ADVANCED WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To expose the students to the importance of improving capacity of wireless channel using MIMO.
- To enable understanding of channel impairment mitigation using space-time block and Trellis codes.
- To teach advanced MIMO system like layered space time codes, MU-MIMO System and MIMO-OFDM systems.

Course Outcomes:

At the end of the course, students should be able to,

CO1 : Comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2 : Apply the knowledge about the importance of MIMO in today's communication.
CO3 : Appreciate the various methods for improving the data rate of wireless communication system
CO4 : Explain the working of layered space time transmitter and receiver
CO5 : Describe various radio propagation techniques.
CO6 : Explain various MIMO systems.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	2	3	3	-	1	-	-	3	2	-	1
CO2	3	2	2	-	3	1	3	-	-	-	-	2	2	1	1
CO3	2	3	2	-	-	3	3	-	-	-	-	2	3	1	-
CO4	2	2	-	-	-	3	3	-	1	-	-	2	3	1	1
CO5	1	1	-	-	3	3	3	-	1	-	-	1	2	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I CAPACITY OF WIRELESS CHANNELS **9**

The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, Data Pipes, Spatial MUX, MIMO System Model. MIMO System Capacity – channel known at the TX, Channel unknown to the TX – capacity of deterministic channels, Random channels and frequency selective channels.

UNIT II RADIO WAVE PROPAGATION **9**

Radio wave propagation – Macroscopic fading- free space and out door, small scale fading Fading measurements – Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity – Diversity combining methods.

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UNIT III SPACE TIME BLOCK CODES 9

Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation - decoding of STBC.

UNIT IV SPACE TIME TRELLIS CODES 9

Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC.

UNIT V LAYERED SPACE TIME CODES 9

LST transmitter – Horizontal and Vertical LST receiver – ML Rx, Zero forcing Rx; MMSE Rx, SIC Rx, ZF V-blast Rx- MMSE V-blast Rx, Iterative Rx - capacity of MIMO – OFDM systems – capacity of MIMO multi user systems.

Total: 45 Hours

Textbooks:

T1. S Mohinder Jankiraman, "Space-time codes and MIMO systems", Artech House, Boston, London.

T2. Paulraj Rohit Nabar, Dhananjay Gore, "Introduction of space time wireless communication systems", Cambridge University Press, 2003.

Reference Books:

R1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.

R2. Sergio Verdu, "Multi User Detection" Cambridge University Press, 1998.

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U19EEOE003	SENSORS AND TRANSDUCERS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To understand the concepts of measurement technology
- To learn the various sensors used to measure various physical parameters
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

Course Outcomes:

At the end of the course, students should be able to,

CO1 : Expertise in various calibration techniques and signal types for sensors
CO2 : Understand about the various sensors.
CO3 : Apply the various sensors in the Automotive and Mechatronics applications.
CO4 : Study the basic principles of various smart sensors.
CO5 : Implement the DAQ systems with different sensors for real time applications.
CO6 : Understand about different sensors with applications.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	3	-	3	2	-	-	2	-	2	-	2	2	2
CO2	2	-	3	-	3	2	-	-	2	-	2	-	3	2	2
CO3	2	-	3	-	3	2	-	-	2	-	2	-	2	3	3
CO4	2	-	3	-	3	2	-	-	2	-	2	-	3	2	2
CO5	2	-	3	-	3	2	-	-	2	-	2	-	2	2	2
CO6	2	-	3	-	3	2	-	-	2	-	2	-	3	2	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 9

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

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UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS 9

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS 9

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

Total: 45 Hours

Textbooks:

T1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009.

T2. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

Reference Books:

R1. Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2010.

R2. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999.

R3. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press , 2015.

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U19EEOE004	ENERGY TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To understand about the non-conventional energy sources.
- To understand about the biomass energy sources.
- To learn the concept of energy conservation

Course Outcomes:

At the end of the course, students should be able to,

CO1 : Understand energy scenario in India
CO2 : Understand conventional Energy sources
CO3 : Understand Non- conventional Energy sources.
CO4 : Understand biomass sources and develop design parameters for equipment to be used in Chemical process industries.
CO5 : Understand energy conservation in process industries.
CO6 : Understand about different energy technology.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	-	3	-	2	-	2	-	2	-	2	2	2
CO2	2	1	3	-	3	-	2	-	2	-	2	-	2	2	2
CO3	2	1	3	-	3	-	2	-	2	-	2	-	2	3	3
CO4	2	1	3	-	3	-	2	-	2	-	2	-	3	2	3
CO5	2	1	3	-	3	-	2	-	2	-	2	-	2	3	2
CO6	2	1	3	-	3	-	2	-	2	-	2	-	3	2	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I ENERGY **9**

Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, energy alternatives.

UNIT II CONVENTIONAL ENERGY **9**

Conventional energy resources - Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants.

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UNIT III NON-CONVENTIONAL ENERGY 9

Solar energy - flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, energy plantations. Wind energy - types of windmills - types of wind rotors, wind electric power generation, wind power in India, economics of wind farm. Ocean wave energy conversion - ocean thermal energy conversion, tidal energy conversion - Geothermal energy.

UNIT IV BIOMASS ENERGY 9

Biomass origin - Resources – Biomass estimation. Thermo chemical conversion – Biological conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.

UNIT V ENERGY CONSERVATION 9

Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmalcing and energy performance, material and energy balance, thermal energy management.

Total: 45 Hours

Textbooks:

T1. Rao, S. and Parulekar, B.B., “Energy Technology”, Khanna Publishers, 2005.

T2. Rai, G.D., “Non-conventional Energy Sources”, Khanna Publishers, New Delhi, 1984.

T3. Nagpal, G.R., “Power Plant Engineering”, Khanna Publishers, 2008

Reference Books:

R1. Nejat Vezirog, “Alternate Energy Sources”, IT, McGraw Hill, New York.

R2. Handbook of Energy Audit by 7th edition Albert Thumann, P.E., C.E.M & William J Younger C.E.M, Faiment Press 2008.

R3. El. Wakil, “Power Plant Technology”, Tata McGraw Hill, New York, 2002.

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U19FTOE003	BEVERAGE TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To Impart knowledge on processing and ingredients applied for beverage preparation according to the standard categorization of beverages.
- To understand quality control measures according to standards and regulations.
- To learn ingredients incorporated and type of processing method applied will give a classification of beverages

Course Outcomes:

At the end of the course, students should be able to,

CO1 : Capable of formulating beverages using various ingredients.
CO2 : Demonstrate various unit operations involved in the food beverage manufacturing.
CO3 : Understand the various production techniques in beverages.
CO4 : Evaluate the quality parameters of all beverages.
CO5 : Familiarize with food laws and regulations of beverages.
CO6 : Understand the natural and artificial colourants used in beverages.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	3	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	1	-	-	3	-	-	-	-	-	-	-	-	-	1	-
CO4	-	-	-	-	3	-	-	2	-	-	-	-	-	-	1
CO5	-	-	-	-	3	-	-	2	-	-	-	-	-	-	1
CO6	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I INGREDIENTS IN BEVERAGES 9

Beverage - definition - ingredients- water, quality evaluation and raw and processed water, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial, Micro and nano-emulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers.

UNIT II CARBONATED BEVERAGES 9

Procedures – ingredients - preparation of Syrup making, carbonation of soft drinks. Carbonation equipments and machineries - containers and closures. Low calorie and dry beverages; isotonic and sports drinks; Fruit based carbonated beverages, carbonated water.

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UNIT III NON-CARBONATED BEVERAGES 9

Beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy based beverages, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages. bottled. Water; mineral water, natural spring water, flavored water.

UNIT IV ALCOHOLIC BEVERAGES 9

Alcoholic beverages - types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipment's used for brewing and distillation, wine and related beverages, distilled spirits

UNIT V SANITATION AND QUALITY CONTROL 9

Quality control, Filling - inspection and quality controls - sanitation and hygiene in beverage industry- Quality of water used in beverages threshold limits of ingredients. FSSAI, EFSA and FDA regulations

Total: 45 Hours

Textbooks:

T1. L.Jagan Mohan Rao and K.Ramalakshmi (2011)"Recent trend in Soft beverages", Woodhead Publishing India Pvt Ltd.

T2. Boulton, Christopher, and David Quain (2008) Brewing yeast and fermentation. John Wiley & Sons.

Reference Books:

R1. Hui, Yiu H., et al., eds. (2004) Handbook of food and beverage fermentation technology. Vol. 134. CRC Press.

R2. Mitchell, Alan J. (199) "Formulation and Production Carbonated Soft Drinks". Springer Science & Business Media.

R3. Woodroof, Jasper Guy, and G. Frank Phillips. (1981) "Beverages: carbonated and noncarbonated". AVI Pub. Co.

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U19FTOE004 PRINCIPLES OF FOOD MATERIALS

L	T	P	C
3	0	0	3

Course Objectives:

This course aims,

- To Explain the milling, extraction and manufacture of tremendous products from cereals, pulses and oil seeds.
- To Summarize the production and processing methods of fruits and vegetables and to discuss the chemical composition, processing, production, spoilage and quality of milk and milk product.
- To Outline the overall processes involved in the production of meat, poultry and fish products Review the production and processing methods of plantation and spice products.

Course Outcomes:

At the end of the course, students should be able to,

CO1 : Capable of formulating beverages using various ingredients.
CO2 : Demonstrate various unit operations involved in the food beverage manufacturing.
CO3 : Understand the various production techniques in beverages.
CO4 : Evaluate the quality parameters of all beverages.
CO5 : Familiarize with food laws and regulations of beverages.
CO6 : Understand the natural and artificial colourants used in beverages.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-
CO4	-	-	-	-	-	3	-	-	2	-	-	-	-	1	-
CO5	-	-	-	-	-	3	-	-	2	-	-	-	-	-	1
CO6	1	1	-	2	-	-	-	-	-	-	-	-	-	-	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I CEREAL, PULSES AND OIL SEEDS TECHNOLOGY 9

Rice milling, Pulse milling, Wheat milling - Oil extraction - Methods of manufacture of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies -Pasta products -Tortilla - Method of manufacture.

UNIT II FRUITS AND VEGETABLE PROCESSING 9

Production of Fruits and vegetables in India, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technology as applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing.

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UNIT III DAIRY PROCESSING 9

Basic dairy terminology, composition, General tests at reception, Dairy Processing - Method of manufacture of Standardized, toned and double toned milk, milk powder - Equipment - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products – Ice cream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage of milk.

UNIT IV MEAT, POULTRY AND FISH PROCESSING 9

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Fish and other Marine Products Processing.

UNIT V PLANTATION PRODUCT TECHNOLOGY 9

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric

Total: 45 Hours

Textbooks:

T1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co. Lucknow. 3rd Edition. 2010

T2. Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post-harvest Technology: Marcel Dekker Press. USA. 1st Edition. 2003

Reference Books:

R1. Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi. 23rd impression. 2016.

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U19ITOE003	FOUNATION OF INFORMATION TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- Understand the basic concepts and terminology of information technology.
- Identify the components of a computer system and their functions.
- Describe different types of software and their applications.
- Explain the principles of computer networking and internet technologies.
- Understand the basics of database design and management.
- Use IT effectively in personal and professional settings.

Course Outcomes:

At the end of the course, students should be able to,

CO1: Understand fundamental concepts, principles, and applications of information technology
CO2: Understand the different types of software and their applications
CO3: Understand the basics of database design and management.
CO4: Understand the role of information systems in organizations and their applications
CO5: Understand the principles of computer networking and internet technologies
CO6: Apply IT effectively in personal and professional settings.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	2	-	2	-	3	2	3	3	-	3
CO2	3	-	3	-	-	2	-	2	-	3	2	3	3	-	3
CO3	3	-	3	-	-	2	-	2	-	3	2	3	3	-	3
CO4	3	-	3	-	-	2	-	2	-	3	2	3	3	-	3
CO5	3	-	3	-	-	2	-	2	-	3	2	3	3	-	3
CO6	3	-	3	-	-	2	-	2	-	3	2	3	3	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I BASICS OF INFORMATION TECHNOLOGY 9

Internet: World Wide Web, Web servers, Web Clients, Web sites, Web Pages, Web Browsers, Blogs, News groups, HTML, Web address, E-mail address, URL, HTTP, FTP, downloading and uploading files from remote site; Services available on Internet: Information Retrieval, locating sites using search engines and finding people on the net; Web Services: Chat, email, Video Conferencing, e-Learning, e-Banking, e-Shopping, e-Reservation, e-Governance, e-Groups, Social Networking.

UNIT II INFORMATION PROCESSING TOOL 9

Office Tools : Database Management Tool : Basic Concepts and need for a database, Creating a database. Data Types - Text, Number, Date, Time, Setting the Primary Key, Entering data into a database, Inserting and deleting Fields, Inserting and deleting Records, Field Size, Default Value, Creating Query using Design view.

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UNIT III HYPER TEXT MARKUP LANGUAGE 9

Introduction to Web Page Designing using HTML, Creating and saving an HTML document, accessing a web page using a web browser (Google Chrome, Internet Explorer, Mozilla Firefox, Opera, Apple Safari, Net scape Navigator); Elements in HTML.

UNIT IV XML 9

Introduction to XML, Difference between XML and HTML with respect to the following: Data separation, data sharing, document structure, tags, nesting of elements, attributes, values. XML Elements - Defining own tags in XML, root elements, child elements and their attributes; Comments in XML, White space and new line in XML, well formed XML documents, validating XML documents, XML Parser, Viewing XML documents in a web browser.

UNIT V SOCIAL IMPACTS OF IT 9

Information Security: Virus, Worms, Trojans and Anti-Virus Software, Spyware, Malware, Spams, Data Backup and recovery tools and methods, Online Backups, Hacker and Cracker with regard to Computer Data and Applications, Social Networking Information security provisions in e-commerce, Benefits of ICT in Education, Healthcare, Governance, Virtual, School, emergence of Knowledge economy, Impact of ICT on Society: Knowledge based society, Infomania, Digital Unity and Digital Divide.

Total: 45 Hours

Textbooks:

T1. Turban, Rainer, and Potter, “Introduction to Information Technology” Wiley, 2015.

T2. Vermaat, Sebok, and Freund, “Discovering Computers” Cengage Learning, 2019

Reference Books:

R1. Vermaat, Sebok, and Freund , “Discovering Computers” Cengage Learning, 2019.

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U19ITOE004	WEB DESIGN AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To Learn the basic concepts in HTML, CSS, Java Script.
- To Understand the responsive design and development.
- To Understand the responsive design and development.
- To Design a Website with HTML, JS, CSS / CMS - Word press.

Course Outcomes:

At the end of the course, students should be able to,

CO1: Understand the principles of web design, including layout, color theory, typography, and user experience design.
CO2: Design Website using HTML CSS and JS
CO3: Design Responsive Sites
CO4: Manage, Maintain and Support Web Apps
CO5: Gain practical experience working on real-world web design projects, and learn how to collaborate with clients, stakeholders, and team members.
CO6: Develop an understanding of web analytics and digital marketing, and learn how to use data to improve website performance and user engagement.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	3	3	2	-	3	-	3	3	3	-	3
CO2	3	-	3	-	3	3	2	-	3	-	3	3	3	-	3
CO3	3	-	3	-	3	3	2	-	3	-	3	3	3	-	3
CO4	3	-	3	-	3	3	2	-	3	-	3	3	3	-	3
CO5	3	-	3	-	3	3	2	-	3	-	3	3	3	-	3
CO6	3	-	3	-	3	3	2	-	3	-	3	3	3	-	3

(3 – High, 2 – Medium, 1 – Low)

UNIT I WEB DESIGN - HTML MARKUP FOR STRUCTURE 9

Working of Web - HTML Markup for Structure - Creating simple page - Marking up text - Adding Links - Adding Images - Table Markup - Forms - HTML5

UNIT II CSS AND JAVASCRIPT 9

CSS - Formatting text - Colours and Background - Padding, Borders and Margins - Floating and positioning - Page Layout with CSS - Transition, Transforms and Animation - Javascript - Using Java Script.

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UNIT III RESPONSIVE WEB DESIGN 9

Sass for Responsive Web Design - Marking Content with HTML5 - Mobile-First or Desktop-First - CSS Grids, CSS Frameworks, UI Kits, and Flexbox for RWD - Designing small UIs by Large Finger - Images and Videos in Responsive Web Design - Meaningful Typography for Responsive Web Design.

UNIT IV WEB PROJECT MANAGEMENT 9

Project Life Cycle - Project Definition - Discovery and Requirements - Project Schedule and Budgeting - Running the project - Technical Documentation - Development , Communication, Documentation - QA and testing -Deployment - Support and operations

UNIT V PROJECT CASE STUDY 9

Using HTML, CSS, JS or using Opensource CMS like Wordpress, design and develop a Website having Aesthetics, Advanced and Minimal UI Transitions based on the project - Host and manage the project live in any public hosting.

Total: 45 Hours

Textbooks:

T1. Jennifer Niederst Robbins, "Learning Web Design", O'REILLY 4th Edition.

T2. Ricardo Zea, "Mastering Responsive Web Design", PACKT Publishing, 2015.

T3. Justin Emond, Chris Steins, "Pro Web Project Management", Apress,2011.

Reference Books:

R1. Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley and Sons, edition 2014.

R2. Jon Duckett, Jack Moore, "JavaScript & J Query: Interactive Front-End Web Development", John Wiley and Sons, edition 2014

R3. Uttam K. Roy "Web Technologies" Oxford University Press, 13th impression, 2017

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U19MEOE003 **AUTOMOBILE TECHNOLOGY**

L	T	P	C
3	0	0	3

Course Objectives:

- To impart knowledge about automobiles.
- To introduce the various parts of automobiles and its functions
- To familiar with the alternative energy sources available.

Course Outcomes:

At the end of the course, students should be able to,

CO1: Describe vehicle structures and types of automobile engines.
CO2: Recognize the various parts of the automobile and their functions and materials.
CO3: Discuss the engine auxiliary systems and engine emission control.
CO4: Distinguish the working of different types of transmission systems.
CO5: Explain the Steering, Brakes and Suspension Systems.
CO6 : Possible alternate sources of energy for IC Engines.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	1	-	3	-
CO2	2	3	1	-	-	-	-	2	-	-	-	2	-	2	-
CO3	3	2	2	-	-	2	-	-	3	-	-	1	-	3	-
CO4	3	2	2	-	-	-	-	2	-	-	-	2	-	2	2
CO5	3	2	2	-	-	-	-	-	-	-	-	1	-	3	-
CO6	3	2	2	-	-	-	-	-	-	2	-	3	-	2	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I VEHICLE STRUCTURES AND ENGINE **9**

Introduction, Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines – components-functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILLIARY SYSTEMS **9**

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

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UNIT III TRANSMISSION SYSTEMS 9

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Overdrive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKE AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS),electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATE ENERGY SOURCES 9

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell.

Total: 45 Hours

Textbooks:

T1. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.

T2. Kirpal Singh, "Automobile Engineering Vol-I & II", Standard publishers, New Delhi, 2011

Reference Books:

R1. Ganesan V. "Internal Combustion Engines", Third Edition, Tata McGraw-Hill, 2012.

R2. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998.

R3. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.

R4. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart – Will Cox Company Inc, USA ,1978.

R5. Newton, Steeds and Garet, "Motor Vehicles", Butterworth Publishers,1989.

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U19MEOE004	CAD/CAM	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand fundamental concepts of computer graphics and its tools in a generic Framework.
- To impart the parametric fundamentals to create and manipulate geometric models using Curves, surfaces and solids.
- To impart the parametric fundamentals to create and manipulate geometric models using NURBS and solids.

Course Outcomes:

At the end of the course, students should be able to,

CO1: Solve 2D and 3D transformations for the basic entities like line and circle.

CO2: Formulate the basic mathematics fundamental to CAD system

CO3: Use the different geometric modeling techniques like feature based modeling, surface Modeling and solid modeling.

CO4: Create geometric models through animation and transform them into real world systems

CO5: Simulate assembly of parts using Computer-Aided Design software.

CO6 : Create strong skills of assembly modeling and prepare the student to be an effective user of a standards in CAD system.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	-	-	-	-	2	-	-	1	1	-
CO2	2	1	-	1	-	-	-	-	-	2	-	-	1	1	-
CO3	2	-	-	-	2	-	-	-	-	2	-	-	-	1	-
CO4	2	1	-	-	2	-	-	-	-	2	-	-	-	1	-
CO5	2	1	-	-	2	-	-	-	-	2	-	-	-	1	-
CO6	3	2	2	-	3	-	-	-	2	2	2	3	2	2	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS 9

Overview of Graphics systems: Video Display Devices, Raster-Scan System, Random-Scan Systems, Graphics Monitors and Workstations, Input Devices, Hard-Copy Devices, Graphics Software. Output primitives: Line Drawing Algorithm - DDA, Brenham's and Parallel Line Algorithm. Circle generating algorithm – Midpoint Circle Algorithm. Geometric Transformations: Coordinate Transformations, Windowing and Clipping, 2D Geometric Transformations - Translation, Scaling, Shearing, Rotation and Reflection, Composite transformation, 3D transformations.

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UNIT II CURVES AND SURFACES MODELING 9

Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations. Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder – synthetic surfaces: Hermite bi-cubic surface- Bezier surface and B-Spline surface- surface manipulations.

UNIT III NURBS AND SOLID MODELING 9

NURBS - Basics- curves, lines, arcs, circle and bi linear surface. Regularized Boolean set operati002002ons - primitive instancing - sweep representations - boundary representations – constructive Solid Geometry - comparison of representations - user interface for solid modeling.

UNIT IV VISUAL REALISM 9

Hidden Line removal, Hidden Surface removal, – Hidden Solid Removal algorithms - Shading – Coloring. Animation - Conventional, Computer animation, Engineering animation - types and techniques.

UNIT V ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE 9

Assembly modeling – Design for manufacture – Design for assembly – computer aided DFMA - inferences of positions and orientation - tolerances analysis –Center of Gravity and mass property Calculations - mechanism simulation. Graphics and computing standards - Data Exchange Standards. Product development and management – new product development –models utilized in Various phases of new product development – managing product life cycle.

Total: 45 Hours

Textbooks:

T1. Ibrahim Zeid, "Mastering CAD/CAM", Tata McGraw Hill, 2nd Edition, 2006

T2. Boothroyd, G, Marcel Dekker, "Assembly Automation and Product Design", New York, 1997.

Reference Books:

R1. Chitale A.K and Gupta R.C, "Product design and manufacturing", PHI learning private limited, 6th Edition, 2015.

R2. David Rogers, James Alan Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill edition.2003.

R3. Donald D Hearn and M. Pauline Baker , "Computer Graphics C Version", Prentice Hall, Inc., 2nd Edition, 1996.

R4. William M Newman and Robert F.Sproull, "Principles of Interactive Computer Graphics", McGraw Hill Book Co. 1st Edition, 2001.

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U19PHOE002	THIN FILM TECHNOLOGY AND APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To learn the fundamental atomistic mechanisms and thin film deposition techniques.
- To acquire knowledge on thin film devices.
- To provide an overview of the wide applications of thin film technology in various technological fields.

Course Outcomes:

At the end of the course, students should be able to,

CO1: Understand the basic concepts of thin film technology.
CO2: Understand the classification of thin films.
CO3: Understand the various thin film deposition techniques.
CO4: Understand and apply the knowledge of different characterization tools and characterization of thin films.
CO5: Describe the properties of thin films.
CO6: Apply the basic knowledge about the wide applications of thin film technology in various technological fields.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

(3 – High, 2 – Medium, 1 – Low)

UNIT I THIN FILM GROWTH 9

Classification of films – formation of films – Condensation and nucleation, growth and coalescence of islands – nucleation theories: capillarity and atomistic models, sticking coefficient, adhesion, substrate effect, film thickness effect.

UNIT II DEPOSITION TECHNIQUES 9

Thin film deposition techniques – simple thermal evaporation – Chemical vapour deposition technique – advantages and disadvantages of Chemical vapour deposition, Physics vapour deposition, electron beam evaporation – RF sputtering, flash evaporation, laser ablation – Spin coating – molecular beam epitaxy – film thickness measurement – ellipsometry, quartz crystal oscillator techniques, structure, and microstructure of thin films.

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UNIT III THIN FILM MATERIAL CHARACTERIZATION TECHNIQUES 9

Characterization techniques: XRD (X-Ray diffraction), working principle of SEM (Scanning Electron Microscopy), working principle of TEM (Transmission Electron Microscopy), STM (Scanning Tunnelling Microscopy), AFM (Atomic Force Microscopy), Filed ion microscope.

UNIT IV PROPERTIES OF THIN FILMS 9

Electrical conduction in continuous and discontinuous metallic thin films, transport and optical properties of metallic, semiconducting and dielectric films.

UNIT V THIN FILM DEVICES AND APPLICATIONS 9

Anti – reflection Coatings, fabrication of thin film resistor, capacitor, diode, gas sensors and temperature sensors. Thin film solar cells, Quantum well and Quantum dot solar cells. Application of thin films, in different areas such as electronics, medical defence, sports, and automobile.

Total: 45 Hours

Textbooks:

T1. Kasturi Chopra, "Thin film device applications", McGraw Hill, Newyork, 2012.

T2. A. Goswami, "Thin film fundamentals", New age international, 2006

Reference Books:

R1. Manuel P. Soriaga, John Stickney, Lawrence A. Bottomley, "Thin Films: Preparation", Characterization, Applications, Springer US.

R2. Krishna Seshan, "Handbook of Thin film Deposition Processes and Techniques", Elsevier.

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U19CHTOE001	ENVIRONMENTAL SCIENCES	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To create an exposure to the basic concepts of environment, ecosystem and biodiversity.
- To gain basic knowledge about various resources of environment.
- To gain knowledge on environmental pollution, threats and engineering problems for solving environmental issues.
- To acquire knowledge about social issues and green chemistry for sustainable development.
- To know about the human interactions with the environment.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Obtain knowledge on awareness about environmental factors.
CO2 : Find scientific, technological, economic and political solutions to environmental pollution.
CO3 : Gain knowledge on interrelationship between living organism and environment.
CO4 : Assess the impact on the human world envision the surrounding environment, its functions and its value.
CO5 : Obtain knowledge on the dynamic processes and understand the features of the earth's interior and surface.
CO6 : Understands the integrated themes and biodiversity, natural resources, pollution control and waste management.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (Pos)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO2	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO3	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO5	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1
CO6	-	-	-	-	-	3	3	-	-	-	-	-	-	-	1

(3 – High, 2 – Medium, 1 – Low)

UNIT I ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic

and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes,etc.

UNIT II ENVRIONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution € Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects andcontrol measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies –disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATRUAL RESOURCES 10

Forest Resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people. Water Resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problem. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food Resources: World food problems, changes causedby agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy Resources: Growing energy needs, renewable and non renewable energy sources, use of alternateenergy sources. Case studies. Land Resources: Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources forsustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND ENVRIONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, globalwarming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machineryinvolved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND ENVIRONMENT 8

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

Total : 45 Hours

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Text Books:

T1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2006.

T2. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Pearson Education, 2004.

Reference Books:

R1. Dharmendra S. Sengar, "Environmental Law", Prentice Hall of India Pvt. Ltd., New Delhi, 2007.

R2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hydrabad, 2015.

R3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt. Ltd., Delhi, 2014.

R4. Rajagopalan.R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005

Web Resources:

W1. https://www.nature.com/scitable/knowledge/library/biodiversity-and-ecosystem-stability-17059965

W2. https://www.eartheclipse.com/environment/types-and-threats-to-natural-resources.html

W3. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-pollution

W4. http://www.scind.org/631/Mindblower/-importance-of-adopting-green-chemistry.html

W5. https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=79926&printable=1

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U19ENOE002	ENGLISH FOR EMPLOYABILITY SKILLS (Common to All)	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To hone the employability-related communication skills of the students on the foundations built during Executive
- To assist students in becoming well-versed, responsible, creative communicators.
- To develop students' knowledge of communication skills in the structure, elucidation, and delivery of messages in diverse cultural and global communities; and
- To promote theoretical understanding and professional/personal practice of effective and ethical human communication between and within a broad range of contexts and communities.
- To write responses appropriately, organize ideas, and use vocabulary accurately.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Be prepared for the personal interview through mock interviews while being aware of the various kinds of interviews.

CO2 : Introspect & develop a planned approach towards his career & life in general..

CO3 : Have clarity on his career exploration process and match his skills and interests with a chosen career path.

CO4 : Explain the use of a functional and chronological resume.

CO5 : Develop thinking ability and polish his expression in group discussions.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
	PROGRAMME OUTCOMES (Pos)												PSOs		
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	2	2	2	3	-	2	-	-	2
CO2	-	-	-	-	-	-	-	1	2	3	-	2	-	-	2
CO3	-	-	-	-	-	2	-	2	3	3	-	2	-	-	2
CO4	-	-	-	-	-	-	3	2	1	3	-	3	-	-	3
CO5	-	-	-	-	-	3	3	3	3	3	-	3	-	-	3
CO6	-	-	-	-	-	-	2	2	2	3	-	2	-	-	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I **9**

SWOT Analysis – Perception Management – Positive Attitude – Empathy – Altruism – Self Management - Etiquette: Social, Dinner, Corporate, Telephone and Netiquette – Interview Skills

UNIT II **9**

Reading Comprehension: Technical passages – Kinds of sentences –Sentence correction – Error spotting – Idioms – Vocabulary: Jargon and Distractors – Punctuation errors – Online Course: Udemy, Edx, Future Learn.

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UNIT III **9**

Letter writing: Formal Letters – Letters accepting Offers - Chart description – process description – Essays — Internship Reports

UNIT IV **9**

Self-Introduction - Talking about friends and Family –Resume Preparation: Single Page and Detailed– Persuasion Skills – Emotional Intelligence – Teamwork - Establishing Credibility: Understanding the Workplace – Body Language

UNIT V **9**

Industry Psychology: Characteristics of the workplace: Physical working conditions: Noise, Illumination, Colour, Music, Miscellaneous Factors Work Schedules: Working Hours, Permanent Part - Time Employment, Flexible Work Schedules; Psychological and Social Issues - Stress management – Time management

Total : 45 Hours

Text Books:

T1. Richards, C. Jack. Interchange Students Book-3 New Delhi: CUP, 2015.

T2. Skills for Employability, Dr. M. Sen Gupta, ISBN: 978-81-933819-1-5, 2020, First Edition.

T3. Soft Skills & Employability Skills, Sabina Pillai, Agna, Cambridge, ISBN: 9781316981320, 1316981320, 2017..

Reference Books:

R1. Bridging the Soft Skills Gap: How to Teach the Missing Basics to Todays Young, ASIN : 8126563435, ISBN-10 : 9788126563432, ISBN-13 : 978-8126563432, Pan Macmillan India; 2016.

R2. Soft Skills Training: A workbook to develop skills for employment, Amazon Digital Services; Large edition, 2012, ISBN-10: 1468096494, ISBN-13 : 978-1468096491.

R3. https://www.sirc-icai.org/images/cabf/Soft%20Skills%20&%20Personality%20Development.pdf.

R4. http://worldwideuniversity.org/library/bookboon/soft-skills.pdf

R5. https://www.futurelearn.com/subjects/business-and-management-courses/soft-skills

Web Resources:

W1. https://bharatskills.gov.in/pdf/E_Books/EmployabilitySkillsSWB2W.pdf

W2. https://link.springer.com/book/10.1007/978-3-319-75166-5

W3. https://www.oreilly.com/library/view/soft-skills-for/9781119875536/

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U19EDOE001	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims,

- To Comprehensive knowledge on basic principles of IPR
- To know the rights and policies related to design, Patents, Copyright and Trademarks
- To understand the statutory provisions of IPRs
- To induce knowledge on Infringements
- To provide knowledge on how to keep the IP rights alive.

Course Outcomes:

At the end of the course students will be able to,

CO1 : Differentiate and explain various forms of IPRs.
CO2 : Identify criteria's to fit one's own intellectual work in particular form of IPRs.
CO3 : Apply statutory provisions to protect particular form of IPRs.
CO4 : Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Design etc**.**
CO5 : Identify procedure to protect different forms of IPRs national and international level.
CO6 : Develop skill of making search using modern tools and technics.

Course Articulation Matrix:

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	1	-	-	-	1	1	1	2
CO2	2	1	-	-	-	2	1	-	2	-	2	1	1	1	-
CO3	-	-	-	-	-	3	-	3	-	1	-	2	2	1	-
CO4	-	2	-	-	-	1	-	3	2	-	-	1	2	1	2
CO5	-	2	1	1	-	2	1	3	1	1	-	2	2	1	-
CO6	2	1	1	-	3	2	1	3	1	-	-	2	2	1	2

(3 – High, 2 – Medium, 1 – Low)

UNIT I INTRODUCTION 9

Basic Concepts - Need for IP - Types of IP - Design, Patent, Copyrights, Trademarks, Geographical Indications - Nature of IP – WTO – WIPO – TRIPS - Inventions and Innovations - Real time examples of IPR.

UNIT II FORMS AND REGISTARTIONS 9

Types of forms - Practical aspects - registration and validity of Design, Patents, Copyrights, Trademarks, Trade secrets and Geographical Indications - Difference between Indian and International Patents - Case studies on Industrial Patents.

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UNIT III AGREEMENTS AND LEGISLATIVE ACTS 9

Patent Act of India - PCT agreement - Design Act - TRIPS Agreement - Patent Amendment Act - Trademark Act - Geographical Indication Act - Conventions and Infringements of IPR

UNIT IV IP LAWS AND DIGITAL INNOVATIONS 9

IP Laws - Cyber Laws - Protection of Innovations - Development of Assets - Unfair Competition - Cyber Laws Realtime case Studies

UNIT V EMERGING TRENDS IN INNOVATIONS AND IPRs 9

Emerging trends - Innovations in various domains - Industry 4.0 - Innocent Infringement - Case Studies ofinnovative products and services solving various social concerns

Total : 45 Hours

Textbooks:

T1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2015.

T2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Publications, New Delhi, 2002.

T3. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.

Reference Books:

R1. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw HillEducation, 2011.

R2. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, EdwardElgar Publishing Ltd., 2013.