GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE – 641 013

B. E. CIVIL ENGINEERING

CURRICULUM

REGULATIONS

2018

OFFICE OF THE CONTROLLER OF EXAMINATIONS

GOVERNMENT COLLEGE OF TECHNOLOGY

COIMBATORE – 641 013.

GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE – 641 013

B. E. CIVIL ENGINEERING

CURRICULUM & SYLLABI

REGULATIONS

2018

OFFICE OF THE CONTROLLER OF EXAMINATIONS

GOVERNMENT COLLEGE OF TECHNOLOGY

COIMBATORE – 641 013.

GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE – 641 013

VISION AND MISSION OF THE INSTITUTION

VISION

To emerge as a centre of excellence and eminence by imparting futuristic technical education in keeping with global standards, making our students technologically competent and ethically strong so that they can readily contribute to the rapid advancement of society and mankind.

MISSION

* To achieve academic excellence through innovative teaching and learning practices.
* To enhance employability and entrepreneurship.
* To improve the research competence to address societal needs.
* To inculcate a culture that supports and reinforces ethical, professional behaviours for a harmonious and prosperous society.

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GOVERNMENT COLLEGE OF TECHNOLOGY

COIMBATORE – 641 013

DEPARTMENT OF CIVIL ENGINEERING

VISION AND MISSION OF THE DEPARTMENT

VISION

Marching towards the centre of excellence in Engineering and Technology with sustainable development to bring out professionals with futuristic vision.

MISSION

* To mould the students to be good planners, designers, executers and ethical Engineers to serve the society and strive for the development of the nation.
* To make Civil Engineering department a renowned high-tech consultancy centre for various Civil Engineering activities.
* To create a nodal centre for providing consulting services during natural calamities.
* To make this department a centre for research and development activities with field interaction.

GOVERNMENT COLLEGE OF TECHNOLOGY

COIMBATORE – 641 013

DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The following Programme Educational Objectives are designed based on the department mission

PEO 1: Graduates will achieve a high level of technical expertise in the subjects related to Civil Engineering and also good in communication skills that help them to achieve and succeed in various positions.

PEO 2: Graduates will have a strong understanding in Mathematics and Sciences which are needed for the application of Civil Engineering principles to do Post Graduate programmes and competitive examinations.

PEO 3: Graduates will get interest on the learning processes and inculcate in them professional ethics, moral values and social concern.

GOVERNMENT COLLEGE OF TECHNOLOGY
COIMBATORE – 641 013
DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problem.
2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **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.
4. **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.
5. **Modern tool usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning in formed by the contextual knowledge to assess societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
7. **Environmental 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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

GOVERNMENT COLLEGE OF TECHNOLOGY

COIMBATORE – 641 013

DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Graduates will be able to handle building materials and resources in a sustainable manner.

PSO2: Graduates will excel in the core areas of Civil Engineering such as Structural Engineering, Environmental Engineering, Geotechnical Engineering, Water Resources Engineering, Transportation Engineering etc.

PSO3: Graduates will execute excellence in solving the Civil Engineering problems based on the learned principles and techniques within stipulated time.

PSO4: Graduates will be able to adapt themselves according to the developments in Civil Engineering.

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE-641013

B.E.CIVIL ENGINEERING

CBCS 2018 REGULATIONS

FIRST SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks
		Induction Programme	MC	0	0	0

Details of the Programme:

Number of Days: 21 Days

Day0: College Admission

Day1: Orientation Programme

Day2: Registration.

Day3 to Day 23 : Induction Programme

Activities:
Physical activity,
Playground Events,
` Practices,
Literary, Proficiency modules,
Team Building,
Lectures by Eminent people,
Familiarization to department,
Branch oriented information,
Motivational speakers,
Talent exposure,
Quiz completion,
Visit to local areas….etc.

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE-641013

B.E.CIVIL ENGINEERING

CBCS 2018 REGULATIONS

FIRST SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18CBS101	Engineering Chemistry	BS	50	50	100	3	1	0	4
2	18CBS102	Calculus and Linear Algebra	BS	50	50	100	3	1	0	4
3	18CES103	Basics of Electrical and Electronics Engineering	ES	50	50	100	3	0	0	3
		PRACTICAL								
4	18CBS104	Chemistry Laboratory	BS	50	50	100	0	0	3	1.5
5	18CES105	Basics of Electrical and Electronics Engineering Laboratory	ES	50	50	100	0	0	3	1.5
6	18CES106	Engineering Graphics	ES	50	50	100	2	0	4	4
		TOTAL		**300**	**300**	**600**	**11**	**2**	**10**	**18**

SECOND SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18CHS201	Communicative English	HS	50	50	100	2	1	0	3
2	18CBS202	Differential Equations and Complex Variables	BS	50	50	100	3	1	0	4
3	18CBS203	Mechanics and Properties of Solids	BS	50	50	100	3	1	0	4
4	18CES204	Programming in C	ES	50	50	100	3	0	0	3
		PRACTICAL								
5	18CBS205	Physics Laboratory	BS	50	50	100	0	0	3	1.5
6	18CES206	Workshop Practice	ES	50	50	100	1	0	4	3
7	18CES207	Programming in C Laboratory	ES	50	50	100	0	0	3	1.5
		TOTAL		**350**	**350**	**700**	**12**	**3**	**10**	**20**

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE-641013

B.E.CIVIL ENGINEERING

CBCS 2018 REGULATIONS

THIRD SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18CBS301	Transform Calculus and Partial Differential Equations	BS	50	50	100	3	1	0	4
2	18CES302	Engineering Mechanics for Civil Engineers	ES	50	50	100	3	1	0	4
3	18CPC303	Strength of Materials	PC	50	50	100	3	1	0	4
4	18CPC304	Mechanics of Fluids	PC	50	50	100	3	0	0	3
5	18CPC305	Surveying	PC	50	50	100	3	0	0	3
6	18CPC306	Water Supply Engineering	PC	50	50	100	3	0	0	3
7	18CMC3Z7	Constitution of India	MC	50	50	100	3	0	0	0
		PRACTICAL								
8	18CPC308	Survey Laboratory	PC	50	50	100	0	0	3	1.5
9	18CPC309	Materials Testing Laboratory	PC	50	50	100	0	0	3	1.5
		TOTAL		**450**	**450**	**900**	**21**	**3**	**6**	**24**

FOURTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18CHS401	Civil Engineering – Societal and Global impact	HS	50	50	100	3	0	0	3
2	18CBS402	Engineering Geology	BS	50	50	100	3	0	0	3
3	18CES403	Construction Materials and Technology	ES	50	50	100	4	0	0	4
4	18CPC404	Basic Structural Design - I (Steel)	PC	50	50	100	3	0	0	3
5	18CPC405	Applied Hydraulics and Fluid Machinery	PC	50	50	100	3	0	0	3
6	18CPC406	Waste Water Engineering	PC	50	50	100	3	0	0	3
7	18CMC4Z7	Environmental Sciences and Engineering	MC	50	50	100	3	0	0	0
		PRACTICAL								
8	18CPC408	Fluid Mechanics and Machinery Laboratory	PC	50	50	100	0	0	3	1.5
9	18CPC409	Environmental Engineering Laboratory	PC	50	50	100	0	0	3	1.5
		TOTAL		**450**	**450**	**900**	**22**	**0**	**6**	**22**

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE-641013

B.E.CIVIL ENGINEERING

CBCS 2018 REGULATIONS

FIFTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18CHS501	Professional Practices, Ethics and Building Bye-laws	HS	50	50	100	3	0	0	3
2	18CPC502	Structural Analysis I	PC	50	50	100	3	0	0	3
3	18CPC503	Basic Structural Design II (Concrete)	PC	50	50	100	3	0	0	3
4	18CPC504	Mechanics of Soils	PC	50	50	100	3	0	0	3
5	18CPE5XX	Professional Elective-I	PE	50	50	100	3	0	0	3
6	18#OE5XX	Open Elective -I	OE	50	50	100	3	0	0	3
		PRACTICAL								
7	18CPC507	Geotechnical Engineering Laboratory	PC	50	50	100	0	0	3	1.5
8	18CEE508	Computer Aided Civil Engineering Drawing	EEC	50	50	100	0	0	3	1.5
		TOTAL		**400**	**400**	**800**	**18**	**0**	**6**	**21**

SIXTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18CPC601	Structural Analysis II	PC	50	50	100	3	0	0	3
2	18CPC602	Foundation Engineering	PC	50	50	100	3	0	0	3
3	18CPC603	Water Resources Engineering	PC	50	50	100	3	0	0	3
4	18CPE6XX	Professional Elective – II	PE	50	50	100	3	0	0	3
5	18#OE6XX	Open Elective –II	OE	50	50	100	3	0	0	3
6	18#OE6XX	Open Elective -III	OE	50	50	100	3	0	0	3
		PRACTICAL								
7	18CPC607	Transportation Engineering Laboratory	EEC	50	50	100	0	0	3	1.5
8	18CEE608	Concrete and Structural Analysis Laboratory	PC	50	50	100	0	0	4	2
		TOTAL		**400**	**400**	**800**	**18**	**0**	**7**	**21.5**

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE-641013

B.E.CIVIL ENGINEERING

CBCS 2018 REGULATIONS

SEVENTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18CPC701	Construction Management	PC	50	50	100	3	0	0	3
2	18CPC702	Engineering Economics, Estimation and Costing	PC	50	50	100	3	0	0	3
3	18CPC703	Prestressed Concrete Structures	PC	50	50	100	3	0	0	3
4	18CPE7XX	Professional Elective - III	PE	50	50	100	3	0	0	3
5	18CPE7XX	Professional Elective - IV	PE	50	50	100	3	0	0	3
6	18#OE7XX	Open Elective -IV	OE	50	50	100	3	0	0	3
		PRACTICAL								
7	18CPC707	Computer Applications Laboratory	PC	50	50	100	0	0	3	1.5
8	18CEE708	Mini Project	EEC	50	50	100	0	0	8	4
		TOTAL		**400**	**400**	**800**	**18**	**0**	**11**	**23.5**

EIGHTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
		THEORY								
1	18CPE8XX	Professional Elective – V	PE	50	50	100	3	0	0	3
2	18CPE8XX	Professional Elective –VI	PE	50	50	100	3	0	0	3
		PRACTICAL								
3	18CEE803	Project Work	EEC	50	50	100	0	0	16	8
		TOTAL		**150**	**150**	**300**	**6**	**0**	**16**	**14**

CATEGORY-WISE CREDIT DISTRIBUTION

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (HS)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18CHS201	Communicative English	HS	50	50	100	2	1	0	3
2	18CHS401	Civil Engineering – Societal and Global impact	HS	50	50	100	3	0	0	3
3	18CHS501	Professional Practices, Ethics and Building Bye-laws	HS	50	50	100	3	0	0	3

BASIC SCIENCES (BS)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
1.	18CBS101	Engineering Chemistry	BS	50	50	100	3	1	0	4
2.	18CBS102	Calculus and Linear Algebra	BS	50	50	100	3	1	0	4
3.	18CBS104	Chemistry Laboratory	BS	50	50	100	0	0	3	1.5
4.	18CBS202	Differential Equations and Complex Variables	BS	50	50	100	3	1	0	4
5.	18CBS203	Mechanics and Properties of Solids	BS	50	50	100	3	1	0	4
6.	18CBS205	Physics Laboratory	BS	50	50	100	0	0	3	1.5
7.	18CBS301	Transform Calculus and Partial Differential Equations	BS	50	50	100	3	1	0	4
8.	18CBS402	Engineering Geology	BS	50	50	100	3	0	0	3

ENGINEERING SCIENCES (ES)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
1.	18CES103	Basics of Electrical and Electronics Engineering	ES	50	50	100	3	0	0	3
2.	18CES105	Basics of Electrical and Electronics Engineering Laboratory	ES	50	50	100	0	0	3	1.5
3.	18CES106	Engineering Graphics	ES	50	50	100	2	0	4	4
4.	18CES204	Programming in C	ES	50	50	100	3	0	0	3
5.	18CES206	Workshop Practice	ES	50	50	100	1	0	4	3
6.	18CES207	Programming in C Laboratory	ES	50	50	100	0	0	3	1.5
7.	18CES302	Engineering Mechanics for Civil Engineers	ES	50	50	100	3	1	0	4
8.	18CES403	Construction Materials and Technology	ES	50	50	100	4	0	0	4

PROFESSIONAL CORE (PC)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18CPC303	Strength of Materials	PC	50	50	100	3	1	0	4
2	18CPC304	Mechanics of Fluids	PC	50	50	100	3	0	0	3
3	18CPC305	Surveying	PC	50	50	100	3	0	0	3
4	18CPC306	Water Supply Engineering	PC	50	50	100	3	0	0	3
5	18CPC308	Survey Laboratory	PC	50	50	100	0	0	3	1.5
6	18CPC309	Materials Testing Laboratory	PC	50	50	100	0	0	3	1.5
7	18CPC404	Basic Structural Design I (Steel)	PC	50	50	100	3	0	0	3
8	18CPC405	Applied Hydraulics and Fluid Machinery	PC	50	50	100	3	0	0	3
9	18CPC406	Waste Water Engineering	PC	50	50	100	3	0	0	3
10	18CPC408	Fluid Mechanics and Machinery Laboratory	PC	50	50	100	0	0	3	1.5
11	18CPC409	Environmental Engineering Laboratory	PC	50	50	100	0	0	3	1.5
12	18CPC502	Structural Analysis I	PC	50	50	100	3	0	0	3
13	18CPC503	Basic Structural Design II (Concrete)	PC	50	50	100	3	0	0	3
14	18CPC504	Mechanics of Soils	PC	50	50	100	3	0	0	3
15	18CPC507	Geotechnical Engineering Laboratory	PC	50	50	100	0	0	3	1.5
16	18CPC601	Structural Analysis II	PC	50	50	100	3	0	0	3
17	18CPC602	Foundation Engineering	PC	50	50	100	3	0	0	3
18	18CPC603	Water Resources Engineering	PC	50	50	100	3	0	0	3
19	18CPC607	Transportation Engineering Laboratory	PC	50	50	100	0	0	3	1.5
20	18CPC701	Construction Management	PC	50	50	100	3	0	0	3
21	18CPC702	Engineering Economics, Estimation and Costing	PC	50	50	100	3	0	0	3
22	18CPC703	Prestressed Concrete Structures	PC	50	50	100	3	0	0	3
23	18CPC707	Computer Applications Laboratory	PC	50	50	100	0	0	3	1.5

PROFESSIONAL ELECTIVES (PE)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
Structural Engineering										
1.	18CPE$01	Steel Structures	PE	50	50	100	3	0	0	3
2.	18CPE$02	Concrete Technology	PE	50	50	100	3	0	0	3
3.	18CPE$03	Finite Element Method	PE	50	50	100	3	0	0	3
4.	18CPE$04	Advanced Concrete Design	PE	50	50	100	3	0	0	3
5.	18CPE$05	Basics of Dynamics and Aseismic Design of Structures	PE	50	50	100	3	0	0	3
6.	18CPE$06	Concrete Structures	PE	50	50	100	3	0	0	3
7.	18CPE$07	Bridge Engineering	PE	50	50	100	3	0	0	3
8.	18CPE$08	Earthquake Engineering	PE	50	50	100	3	0	0	3
9.	18CPE$09	Safety in Civil Engineering Practices	PE	50	50	100	3	0	0	3
10.	18CPE$10	Valuation	PE	50	50	100	3	0	0	3
Environmental Engineering										
11.	18CPE$11	Design and Drawing (Irrigation and Environmental Engineering)	PE	50	50	100	2	0	2	3
12.	18CPE$12	Environmental Legislations in India	PE	50	50	100	3	0	0	3
13.	18CPE$13	Industrial Wastewater Management	PE	50	50	100	3	0	0	3
14.	18CPE$14	Sustainable Engineering and Technology	PE	50	50	100	3	0	0	3
Geotechnical and Transportation Engineering										
15.	18CPE$15	Ground Improvement Techniques	PE	50	50	100	3	0	0	3
16.	18CPE$16	Pavement Engineering	PE	50	50	100	3	0	0	3
17.	18CPE$17	Airport, Docks and Harbour Engineering	PE	50	50	100	3	0	0	3
18.	18CPE$18	Highways – State of Art	PE	50	50	100	3	0	0	3
19.	18CPE$19	Traffic Engineering and Management	PE	50	50	100	3	0	0	3
20.	18CPE$20	Fundamentals of Remote Sensing and GIS Applications	PE	50	50	100	3	0	0	3
21.	18CPE$21	Highway and Railway Engineering	PE	50	50	100	3	0	0	3
Hydraulics and Hydrology										
22.	18CPE$22	Irrigation Engineering and Hydraulic Structures	PE	50	50	100	3	0	0	3
23.	18CPE$23	Hydrology	PE	50	50	100	3	0	0	3
Construction Engineering and Management										
24.	18CPE$24	Maintenance and Rehabilitation of Structures	PE	50	50	100	3	0	0	3
25.	18CPE$25	Prefabricated Structures	PE	50	50	100	3	0	0	3

OPEN ELECTIVES (O.E)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
1.	18COE$01	Climate Change and Adaptation	OE	50	50	100	3	0	0	3
2.	18COE$02	Disaster Management and Mitigation	OE	50	50	100	3	0	0	3
3.	18COE$03	Energy Efficient Buildings	OE	50	50	100	3	0	0	3
4.	18MOE$04	Nanotechnology and Surface Engineering	OE	50	50	100	3	0	0	3
5.	18MOE$05	Mechatronics	OE	50	50	100	3	0	0	3
6.	18EOE$07	Renewable Power Generation Systems	OE	50	50	100	3	0	0	3
7.	18EOE$08	Electric Vehicles	OE	50	50	100	3	0	0	3
8.	18EOE$09	Smart Grid Systems	OE	50	50	100	3	0	0	3
9.	18LOE$10	Mobile Communication	OE	50	50	100	3	0	0	3
10.	18LOE$11	Introduction to VLSI System Design	OE	50	50	100	3	0	0	3
11.	18LOE$12	Microcontroller and Applications	OE	50	50	100	3	0	0	3
12.	18POE$13	Rapid Prototyping	OE	50	50	100	3	0	0	3
13.	18POE$14	Managerial Economics	OE	50	50	100	3	0	0	3
14.	18POE$15	Hydraulics and Pneumatics	OE	50	50	100	3	0	0	3
15.	18NOE$16	Measurement and Control	OE	50	50	100	3	0	0	3
16.	18NOE$17	Industrial Automation	OE	50	50	100	3	0	0	3
17.	18NOE$18	Virtual Instrumentation	OE	50	50	100	3	0	0	3
18.	18SOE$19	Programming in Java	OE	50	50	100	3	0	0	3
19.	18SOE$20	Cyber Security	OE	50	50	100	3	0	0	3
20.	18SOE$21	Network Essentials	OE	50	50	100	3	0	0	3
21.	18IOE$22	Programming in Python	OE	50	50	100	3	0	0	3
22.	18IOE$23	Big Data Science	OE	50	50	100	3	0	0	3
23.	18IOE$24	Object Oriented Programming Using C++	OE	50	50	100	3	0	0	3
24.	18BOE$25	Computational Biology	OE	50	50	100	3	0	0	3
25.	18BOE$26	Fundamental Concepts of Biology for Engineers	OE	50	50	100	3	0	0	3
26.	18BOE$27	Fundamentals of Bioengineering	OE	50	50	100	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC) – PRACTICAL COURSES AND PROJECT WORK

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18CEE508	Computer Aided Civil Engineering Drawing	EEC	50	50	100	0	0	3	1.5
2	18CEE608	Concrete and Structural Analysis Laboratory	EEC	50	50	100	0	0	4	2
3	18CEE708	Mini Project	EEC	50	50	100	0	0	8	4
4	18CEE803	Project Work	EEC	50	50	100	0	0	16	8

MANDATORY COURSE (MC) (NO - CREDIT)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18CMC3Z7	Constitution of India	MC	50	50	100	3	0	0	0
2	18CMC4Z7	Environmental Sciences and Engineering	MC	50	50	100	3	0	0	0

VALUE ADDED COURSES (VA) (ONE - CREDIT)

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
1	18CVA$01	Surveying using Total Station and Autoplotter 8	VA	100	-	100	1	0	0	1
2	18CVA$02	Environmental Audit	VA	100	-	100	1	0	0	1
3	18CVA$03	Yoga for Youth empowerment	VA	100	-	100	1	0	0	1

SUMMARY OF CREDIT DISTRIBUTION

Sl. No.	Course component	Credits per semester								GCT Total Credit	% of Total Credit	Suggested Credit
		I	II	III	IV	V	VI	VII	VIII			
1	Humanities and Social Sciences including management (HS)	-	3	-	3	3	-	-	-	9	**5.5**	**12**
2	Basic Sciences (BS)	9.5	9.5	4	3	-	-	-	-	26	**15.9**	**25**
3	Engineering Sciences (ES)	8.5	7.5	4	4	-	-	-	-	24	**14.6**	**25**
4	Professional Core (PC)	-	-	16	12	10.5	10.5	10.5	-	59.5	**36.3**	**52.5**
5	Professional Elective (PE)	-	-	-	-	3	3	6	6	18	**11.0**	**18**
6	Open Elective (OE)	-	-	-	-	3	6	3	-	12	**7.3**	**12**
7	Employability Enhancement Course (EEC)	-	-	-	-	1.5	2	4	8	15.5	**9.5**	**15.5**
8	Mandatory course (MC)	-	-	-	-	-	-	-	-	-	**0**	**-**
9	Value added Course (VA)	-	-	-	-	-	-	-	-	-	**0**	**-**
	Total	**18**	**20**	**24**	**22**	**21**	**21.5**	**23.5**	**14**	**164**	**100**	**160**

HS	Humanities and Social Sciences including Management
BS	Basic Sciences
ES	Engineering Sciences
PC	Professional Core
PE	Professional Elective
OE	Open Elective
EEC	Employability Enhancement Courses
MC	Mandatory Course

18CBS101	ENGINEERING CHEMISTRY *(Common to CIVIL, MECH & PRODN Branches)*	SEMESTER I

Category: BS

PRE-REQUISITES: NIL

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- The course is aimed at imparting knowledge of Engineering Chemistry topics which would be useful for students to understand chemistry relevant to conventional engineering fields.

UNIT-I : WATER TECHNOLOGY (9+3 Periods)

Water- sources - types of impurities, hardness - temporary and permanent – units - ppm and mg/L - estimation of hardness – EDTA method- problems- Boiler troubles- internal treatment – external treatment- lime soda process and ion exchange process- Drinking water - characteristics- colour, odour, turbidity, chloride - treatment - preliminary, primary and disinfection methods- chlorination-breakpoint chlorination, desalination – reverse osmosis.

UNIT-II : SPECTROSCOPIC TECHNIQUES AND APPLICATIONS (9+3 Periods)

Beer Lambert's law -UV visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only)- flame photometry- principle – instrumentation (block diagram only)- estimation of sodium by flame photometry- Atomic absorption spectroscopy – principles – instrumentation(block diagram only) – estimation of nickel by atomic absorption spectroscopy.

UNIT-III : FUELS AND COMBUSTION (9+3 Periods)

Fuels- classifications - calorific value - Gross and Net calorific value - combustion –theoretical air-principle and calculations - solid fuels - Coal-proximate and ultimate analysis- significance- Coke-characteristics- manufacture by Otto Hoffman method - Liquid fuels – petroleum fractionation - petrol and diesel - knocking of ic engines and diesel engines - octane and cetane number- anti-knocking agents – Biogas – biodiesel.

UNIT-IV : ENGINEERING MATERIALS (9+3 Periods)

Refractories – classification - properties and manufacture of silica and magnesia bricks; Abrasives-Classification, properties - manufacture of SiC -; Lubricants –solid lubricants (Graphite & Molybdenum sulphide) hydrodynamic mechanism of lubrication – Cement – manufacture - setting and hardening of cement - special cements - Alumina cement and waterproof cement.

UNIT-V : CORROSION (9+3 Periods)

Corrosion – Spontaneity - Chemical corrosion- mechanism, nature of oxides – Pilling Bedworth rule - Electrochemical corrosion- mechanism – Galvanic series and importance – Prevention methods - design of materials, cathodic protection techniques (sacrificial anode and impressed current cathode), Inhibitors - Protective coatings -Inorganic coating- electroplating – surface preparation and plating method applied to Cr and Ni and galvanizing – Organic coating - paints- constituents and functions.

Contact Periods:
Lecture: 45 Periods Tutorial:15 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS:

1. *Jain. P.C. and Monica Jain,* ***"Engineering Chemistry",*** *Dhanpat Rai Publications Pvt. Ltd, New Delhi, 16th Edition, 2017.*
2. *Vairam.S, Subha Ramesh,* ***"Engineering Chemistry****", Wiley India, 2015.*

REFERENCE BOOKS:

1. *Dara. S.S, Umarae, "****Text book of Engineering Chemistry****", S. Chand Publications, 2004.*
2. *Agarwal, C.V. "****Chemistry of Engineering Materials"****, 9th Edition, B.S. Publications, 2006.*
3. *Kuriakose, J.C., and Rajaram J, "****Chemistry in Engineering and Technology****", vol.1 & II, Tata Mc Graw Hill Publishing company Pvt.Ltd, New Delhi, 2001*
4. *Y R Sharma ,* ***"Elementary Organic Spectroscopy"****, S. Chand Publications, 2013.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Identify the nature of impurities and the effects of various sources of water, and apply them in treatment them usable for industrial and domestic purposes.

CO2: Describe the different types of polymeric materials, properties and fabrication which match the specific applications.

CO3: Recognize the different types of fuels with their compositions, combustion characteristics In engines and apply them in design of combustion chambers.

CO4: Summarize the various engineering materials, refractories, abrasives, lubricants and cements with their properties and manufacturing methods which are used in engineering applications.

CO5: Gain the knowledge about corrosion of the machinery they use in their fields and, also to understand the mechanisms and to adopt the preventive measures by various techniques.

COURSE ARTICULATION MATRIX:

PO/CO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	L	H	L	L	M	M	--	--	L	--	--	--	L	M	--	--
CO2	L	L	--	L	L	--	--	--	--	--	--	--	--	L	--	--
CO3	L	M	--	--	--	--	--	--	--	--	--	--	--	L	--	--
CO4	H	--	L	M	L	--	--	--	--	--	L	M	H	L	--	L
CO5	L	L	L	H	L	--	--	--	L	--	--	L	M	M	--	--
18CBS101	M	L	L	M	L	L	--	--	L	--	L	L	L	M	--	L

L-Low, M-Moderate (Medium), H-High

18CBS102	CALCULUS AND LINEAR ALGEBRA (*Common to Civil, Mech, Prodn. & IBT Branches)*	SEMESTER I

Category: BS

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

L	T	P	C
3	1	0	4

- To be familiar with differentiation of single variable and its applications.
- To obtain the knowledge of definite and improper integration and applications.
- To acquire knowledge of differentiation for more than one variable and vector differentiation.
- To gain the knowledge of multiple integration and related applications and vector integration including theorems.
- To know about matrix theory used to solve linear system and diagonalise a matrix by transformation.

UNIT-I: DIFFERENTIAL CALCULUS (9+3 Periods)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems, indeterminate forms and L'Hospital's rule, Maxima and minima, Evolute of a curve.

UNIT-II: INTEGRAL CALCULUS (9+3 Periods)

Evaluation of definite and improper integrals, Beta and Gamma functions and their properties, Applications of definite integrals to evaluate surface areas and volume of revolution.

UNIT-III: MULTIVARIABLE CALCULUS (DIFFERENTIATION) (9+3 Periods)

Limit, continuity and partial derivatives, total derivative, Jacobians, Maxima, minima and saddle points, Method of Lagrange multipliers, Gradient, curl and divergence.

UNIT-IV: MULTIVARIABLE CALCULUS (INTEGRATION) (9+3 Periods)

Multiple integration - Double integrals, change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), Change of variables (Cartesian to spherical polar). Theorems of Green, Gauss and Stokes, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT-V: MATRICES (9+3 Periods)

Inverse and rank of a matrix, System of linear equations, Eigenvalues and eigenvectors, Diagonalization of matrices, Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Contact Periods:
Lecture: 45 Periods Tutorial:15 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS:

1. *Veerarajan T., **Engineering Mathematics (for first year)**, Tata McGraw-Hill, New Delhi, 2008.*
2. *Srimanta Pal and suboth.C.Bhunia, **Engineering Mathematics**, Oxford university publications, New Delhi, 2015.*

REFERENCE BOOKS:

1. *B.S.Grewal,* ***Higher Engineering*** *Mathematics, Khanna Publishers, 43rd Edition, 2015.*
2. *Erwinkreyszig,* ***Advanced Engineering Mathematics****, 9thEdition, John Wiley&Sons, 2006.*
3. *Sivaramakrishnadas.P, Rukmangadachari.E,* ***Engineering Mathematics****, Pearson, Chennai & Delhi, 2ndEdition, 2013.*
4. *James Stewart,* ***Essential Calculus****, Cengage Learning, Delhi, 2ndEdition, 2013.*
5. *Howard Anton, IRL Bivens, Stephen Davis,* ***Calculus****, Wiley, New Delhi, 10thEdition, 2013.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Know the standard theorems and applications like maxima and minima, evolute of a curve using principles of differentiation.

CO2: Acquire fluency in integration of one variable for definite and improper integrals like beta and gamma functions and also applications of area and volumes.

CO3: Apply the techniques of partial differentiation and vector differentiation.

CO4: Apply multiple integration for finding area, surface and volume and applications to Green's, Stoke's and Gauss theorems on Vector Calculus.

CO5: Solve the linear system of equations by rank of a matrix and matrix inversion and understand the process of diagonalisation by orthogonal transformation.

COURSE ARTICULATION MATRIX:

PO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
CO2	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
CO3	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
CO4	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
CO5	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
18CBS102	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-

L-Low, M-Moderate (Medium), H-High

18CES103	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING *(Common to Civil & IBT Branches)*	SEMESTER I

Category: ES

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

L	T	P	C
3	0	0	3

- To study the basic concepts of electric circuits, electronic devices and communication engineering.
- To know the fundamentals of DC and AC machines.
- To introduce the components of Electrical installations and energy conservation.

UNIT-I : ELECTRICAL CIRCUITS (9 Periods)

Electrical circuit elements (R,L and C) - Voltage and current sources – Ohm's Law – Kirchoff laws – Steady state solutions of DC circuits – Time domain analysis of First order RL and RC circuits – Representation of sinusoidal waveforms – Average, RMS and Peak values – Phasor representation – Real, Reactive, Apparent power and power factor – Three phase balanced circuits – Voltage and current relations in star – delta connections.

UNIT-II : ELECTRICAL MACHINES AND MEASUREMENTS (9 Periods)

Construction, Principle of Operation, basic equations and Types, Characteristics and Applications of DC generators, DC motors, Single phase Transformer, Single phase and Three phase Induction motor - Components of Hydroelectric power plant.
Operating principles of Moving coil, Moving iron Instruments (Ammeter and Voltmeters), Dynamometer type watt meters and Energy meters.

UNIT-III : ANALOG AND DIGITAL ELECTRONICS (9 Periods)

Analog Electronics: semiconductor devices – P-N junction diode, Zener diode, BJT, Operational amplifier – principle of operation, Characteristics and applications.
Digital Electronics: Introduction to numbers systems, basic Boolean laws, reduction of Boolean expressions and implementation with logic gates – Flip flops - Registers and Counters – A/D and D/A conversion – Introduction to Integrated Circuits (ICs)

UNIT-IV: FUNDAMENTAL OF COMMUNICATION ENGINEERING (9 Periods)

Types of Signals : Analog and Digital Signals – Modulation and Demodulation :Principles of Amplitude and Frequency Modulations
Communication Systems : Radio, TV, Microwave, Satellite, RADAR and Optical Fibre (Block diagram approach only)

UNIT-V : ELECTRICAL INSTALLATIONS AND ENERGY CONSERVATION **(9 Periods)**

Single phase and three phase system – phase, neutral and earth, basic house wiring -tools and components, different types of wiring - basic safety measures at home and industry – Energy efficient lamps - Energy billing.

Components of LT switchgear : Switch fuse unit, MCB, ELCB, MCCB, Types of wires and Cables – Earthing Batteries – Principle, characteristics, types and applications – DC-DC converters, Single phase /Three phase Inverters - Introduction to UPS and SMPS.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *R.Muthusubramaniam,R.Salivaganan, Muralidharan K.A., "**Basic Electrical and Electronics Engineering**" Tata McGraw Hill , Second Edition 2010.*
2. *Mittle V.N and Aravind Mittal**, "Basic Electrical Engineering"**, Tata McGraw Hill, Second Edition, New Delhi, 2005.*
3. *D.P.Kothari, I.J. Nagrath, **"Basic Electrical Engineering**", Tata McGraw Hill, 2010.*

REFERENCE BOOKS:

1. *Nagsarkar T.K and Sukhija M.S, **"Basic Electrical Engineering**", Oxford Press, 2005.*
2. *E.Hughes,**"Electrical and Elecronics Technology"**, Pearson, 2010*
3. *Mohmood Nahvi and Joseph A.Edminister, **"Electric Circuits"**, Shaum Outline series, McGraw Hill, Sixth edition, 2014*
4. *Premkumar N and Gnanavadivel J, **"Basic Electrical and Electronics Engineering"**, Anuradha Publishers, 4th Edition, 2008.*

COURSE OUTCOMES

Upon completion of the course, the student will be able to

CO1: Analyze the DC and AC circuits.
CO2: Describe the significance of Electrical Machines.
CO3: Obtain the knowledge on semiconductor devices and Digital electronics.
CO4: Identify the concept of Communication engineering.
CO5: Practice the Assembly of electrical wiring and electrical installations.

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COURSE ARTICULATION MATRIX:

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	M	H	M	L	-	L	M	L	-	L	-	-	L	L	-
CO2	H	M	M	L	L	M	L	M	M	M	M	L	-	L	L	-
CO3	M	M	M	L	M	-	-	L	L	L	-	-	-	L	L	-
CO4	H	H	M	M	L	M	L	L	M	M	L	L	-	L	L	-
CO5	M	L	M	L	M	L	L	M	-	L	L	L	-	L	L	-
18CES103	H	M	M	L	L	M	L	M	M	M	L	L	-	L	L	-

L-Low, M-Moderate (Medium), H-High

18CBS104	CHEMISTRY LABORATORY *(Common to all Branches)*	SEMESTER I

Category: BS

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

L	T	P	C
0	0	3	1.5

- To inculcate the practical applications of chemistry to students and make them apply in the fields of engineering and technology.

LIST OF EXPERIMENTS **30 Periods**

1. Estimation of hardness by EDTA method.
2. Estimation of chloride by Argentometric method.
3. Conductometric titration of mixture of strong acid and weak acid using strong base.
4. Potentiometric titration of ferrous iron by dichromate.
5. Determination of Saponification value of an oil.
6. Estimation of Iron by Spectrophotometry.
7. Estimation of HCl by pH titration.
8. Determination of the rate constant of reaction.
9. Estimation of Dissolved Oxygen.

Contact Periods:
Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**

REFERENCE BOOKS:

1. *A.O. Thomas, **"Practical Chemistry"**, Scientific Book Centre, Cannanore, 2003.*
2. *Vogel's **"Text book of Quantitative Analysis"**, Jeffery G H, Basset J. Menthom J, Denney R.C., 6th Edition, EBS, 2009.*

COURSE OUTCOMES:

Upon the completion of the course, the student will be able to

CO1: Examine the nature of hardness using EDTA Complex
CO2 :Determine Iron present in water , chloride level and pollution level using dissolved oxygen content.
CO3: Apply the EMF and conductometric measurements in quantitative analysis of Substances.
CO4: Estimate the pH of the liquid sample and hence strength of the sample can be observed using pH Meter

COURSE ARTICULATION MATRIX:

PO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	M	--	--	L	--	--	--	--	--	L	M	--	L	--
CO2	L	H	--	M	L	--	--	--	--	--	--	--	--	--	--	L
CO3	M	L	--	M	--	--	--	--	--	--	--	--	--	--	M	--
CO4	L	M	--	L	L	--	--	--	--	--	--	--	L	--	--	--
18CBS104	M	M	L	M	L	L	--	--	--	--	--	L	L	--	L	L

L-Low, M-Moderate (Medium), H-High

18CES105	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY *(Common to Civil & IBT Branches)*	SEMESTER I

Category: ES

PRE-REQUISITES: NIL

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To understand the performance characteristics of DC and AC machines
- To calibrate and Measuring capability of the DC/AC meters and study the characteristics of electronics devices
- To impart practical knowledge on Wiring and study the performance characteristics of batteries

LIST OF EXPERIMENTS

1. Verification of Ohm's law and Kirchoff's law
2. Measurement of three phase power by two wattmeter method
3. Calibrations of Ammeter, Voltmeter, Wattmeter and Single phase Energy meter
4. Measurements of voltage, current, power on primary and secondary side of single phase and three phase transformers
5. Measurement of AC signal parameters using CRO/DSO and Function generators
6. Demonstration of cut out sections of DC and AC machines
7. Open circuit characteristics and load test on d.c. shunt generator.
8. Speed control of d.c. shunt motor.
9. Load test on single phase transformer.
10. Verification of logic gates, implementation of digital logic circuits
11. Demonstration of DC-DC converters, DC-AC c converters
12. Study of components of LT Switchgear
13. Fluorescent lamp wiring, Stair case wiring and Residential house wiring using fuse, indicator, lamp and energy meter.
14. Study of battery characteristics during charging and discharging.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Validate Ohm's law and Kirchoff's law on electrical circuits
CO2: Compute the characteristics of DC machines and transformers.
CO3: Observe the Measurements on DC and AC Instruments
CO4: Record the Implementation of logic circuits
CO5: Prepare the domestic and industrial wiring.

COURSE ARTICULATION MATRIX:

PO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H	M	L	-	L	L	L	-	L	-	-	L	L	-
CO2	H	M	M	L	L	M	L	M	M	M	M	L	-	L	L	-
CO3	M	M	M	L	M	-	-	L	L	L	-	-	-	L	L	-
CO4	H	H	M	M	L	M	M	L	M	M	L	L	-	L	L	-
CO5	M	L	M	L	M	L	L	M	-	L	L	L	-	L	L	-
18CES105	M	M	M	L	L	M	L	L	L	L	L	L	-	L	L	-

L-Low, M-Moderate (Medium), H-High

18CES106	ENGINEERING GRAPHICS *(Common to All Branches)*	SEMESTER I

Category: ES

PRE-REQUISITES: NIL

L	T	P	C
2	0	4	4

COURSE OBJECTIVES:

- Geometrical constructions
- Orthographic projections.
- Performing section of solids and development of the same.
- Pictorial view of solids
- Familiarization of CAD packages.

UNIT-I : GEOMETRICAL CONSTRUCTIONS (6+12 Periods)

Dimensioning-Lettering-Types of Lines-Scaling conventions-Dividing a given straight line in to any number of equal parts- Bisecting a given angle- Drawing a regular polygon given one side-Special methods of constructing a pentagon and hexagon.

UNIT-II : ORTHOGRAPHIC PROJECTIONS (6+12 Periods)

Introduction to Orthographic Projection-Projection of points-Projection of straight lines with traces - Conversion of pictorial views to orthographic views-Projection of solids

UNIT-III : SECTION OF SOLIDS AND DEVELOPMENT (6+12 Periods)

Section of solids- Development of surfaces

UNIT-IV : PICTORIAL VIEWS (6+12 Periods)

Isometric projections - Conversion of orthographic views to pictorial views (simple objects).

UNIT-V : COMPUTER AIDED DRAFTING (6+12 Periods)

Introduction to computer aided drafting package to make 2-D Drawings. OBJECT CONSTRUCTION – page layout – Layers and Line type – Creating, Editing and selecting the Geometric Objects MECHANICS – Viewing, Annotating, Hatching and Dimensioning the drawing – Creating Blocks and Attributes, DRAFTING – Create 2D drawing. A number of chosen problems will be solved to illustrate the concepts clearly.
(Demonstration purpose only, not be included in examinations)

Contact Periods:
Lecture: 30 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 90 Periods

TEXT BOOKS:

1. *K.Venugopal, **"Engineering Graphics"**, New Age International (P) Limited, 2015.*
2. *K.L.Narayana and P.Kannaiah, **"Text book on Engineering Drawing,"** 2nd Edition, SciTech Publications (India) Pvt. Ltd, Chennai, 2009.*

REFERENCE BOOKS:

1. *Dhananjay.A.Jolhe, **"Engineering Drawing"**, Tata McGraw Hill Publishing Co., 2007.*
2. *K.V.Nataraajan, **"A text book of Engineering Graphics"**, Dhanalakashmi Publishers, Chennai, 2006.*
3. *M.B.Shah and B.C. Rana, **"Engineering Drawing"**, Pearson Education, 2005.*
4. *Luzadder and Duff, **"Fundamentals of Engineering Drawing"**, Prentice Hall of India Pvt Ltd, XIth Edition, 2001.*
5. *Alan Kalameja, "**AutoCAD 2008: A tutor for Engineering Graphics",** Auto Desk Press 2007*
6. *CAD Software manuals of latest version.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Construct basic geometric shapes and dimension the drawing as per standards.
CO2: Convert 2D projections to pictorial projections and Project points, lines and solids in various positions
CO3: Develop sectional views of solids and construct development drawings.
CO4: Interpret and Generate pictorial views.
CO5: Create simple Engineering Drawings using AUTO CAD.

COURSE ARTICULATION MATRIX:

PO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	--	--	L	--	M	L	--	--	M	M	L	--	--	L	--	--
CO2	--	--	L	--	M	L	--	--	M	M	L	--	--	L	--	--
CO3	--	--	L	--	H	L	--	--	M	M	L	--	--	L	--	--
CO4	--	--	L	--	H	L	--	--	M	M	L	--	--	L	--	--
CO5	--	--	L	--	H	L	--	--	M	M	L	--	--	L	--	--
18CES106	--	--	L	--	H	L	--	--	M	M	L	--	--	L	--	--

L-Low, M-Moderate (Medium), H-High

18CHS201	COMMUNICATIVE ENGLISH *(Common to all Branches)*	SEMESTER II

Category: HS

PRE-REQUISITES: NIL

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:

The course is intended to

- Make learners listen to audio files and replicate in speaking contexts
- Make learners read widely and practice it in writing
- Make learners develop vocabulary and strengthen grammatical understanding

UNIT-I : LISTENING **(6+3 Periods)**

Listening Comprehension, Pronunciation, Intonation, Stress, Pause, Rhythm, Listening to Short & Long Conversations/Monologues - Note-Taking.

UNIT-II : SPEAKING **(6+3 Periods)**

Self Introduction, Making Oral & Formal Presentation, Communication at Work Place, Mock Interviews, Role Play Activities, Group Discussions, Debates, Delivering Welcome Address, Proposing Vote of Thanks, Introducing the Chief Guest at a function.

UNIT-III : READING **(6+3 Periods)**

Reading Comprehension, Speed Reading, Interpreting Visual Materials (Signs, Post Cards Pictures, Labels Etc.), Reading for Specific Information-Reading to identify Stylistic Features (Syntax, Lexis, Sentence Structures)-Cloze Test.

UNIT-IV : WRITING **(6+3 Periods)**

Phrase, Clause And Sentence Structures, Punctuation, Discourse Markers, Coherence, Precision in Writing, Graph & Process Description-Definition, Writing Email-Paraphrasing, Note making, Job Application With Resume, Writing Review of a Book / Movie, Creative Writing.

UNIT-V : GRAMMAR AND VOCABULARY **(6+3 Periods)**

Word Formation with Prefix and Suffix, Synonyms and Antonyms, Tenses, Parts of Speech, Common Errors in English (Subject –Verb Agreement, Noun-Pronoun Agreement, Prepositions, Articles, Conditional statements, Redundancies, Clichés etc), Voices.

Contact Periods:
Lecture: 30 Periods Tutorial:15 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. ***Board of Editors, Using English****, Orient Black Swan, 2015.*

REFERENCE BOOKS:

1. ***Practical English Usage****, Michael Swan. OUP 1995.*
2. ***Cambridge BEC Vantage*** *- Practice Tests, Self-study Edition, CUP, 2002*
3. ***Exercises in Spoken English****. **Parts. I –III.** EFLU, Hyderabad, OUP, 2014*
4. ***Indlish****. Jyothi Sanyal, Viva Books,2006*
5. ***Communicative English****. J.Anbazhagan Vijay, Global Publishers, Chennai. 2018*

WEB REFERENCES

1. *www.cambridgeenglish.org/exams/business.../business-preliminary/*
2. *http://www.examenglish.com/BEC/BEC_Vantage.html*
3. *www.splendid-speaking.com/exams/**bec**_speaking.htmlhtml*

COURSE OUTCOMES:

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

CO1: Express listening capacity through various accents and discourse
CO2: Practice better at various public meeting and work place environments.
CO3: Integrate Read and strengthen their interpretive and linguistic skills.
CO4: Write appropriately on technical, business and general contexts.
CO5: Summarize the usage of grammar and vocabulary

COURSE ARTICULATION MATRIX:

PO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	--	--	--	M	H	L	M	--	H	H	M	H	--	--	L	L
CO2	--	--	--	H	H	L	M	M	H	H	M	L	--	--	L	L
CO3	--	--	--	H	H	L	M	M	--	H	M	H	--	--	L	L
CO4	--	--	--	H	H	L	M	M	--	H	M	L	--	--	L	L
CO5	--	--	--	L	H	L	--	--	--	H	M	H	--	--	L	L
18CHS201	--	--	--	H	H	L	M	M	M	H	M	M	--	--	L	L

L-Low, M-Moderate (Medium), H-High

18CBS202	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES *(Common to Civil, Mech, Prodn.& IBT Branches)*	SEMESTER II

Category: BS

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

L	T	P	C
3	1	0	4

- To gain methods to solve second order differential equations with constant and variable coefficients.
- To be familiarize with formation and solutions of first order partial differential equation.
- To be understood with solutions of higher order partial differential equation and product solutions to standard PDEs.
- To be known about analytic functions with properties, construction of analytic function and the knowledge of conformal transformation.
- To obtain the knowledge of Cauchy's integral theorems, calculus of residues and complex integration around unit circle and semicircle.

UNIT-I: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER (9+3 Periods)

Second order linear differential equations with constant and variable coefficients, Cauchy-Euler equation, Cauchy-Legendre equation. Method of variation of parameters, Power series solutions of Differential equations with Bessel and Legendre functions.

UNIT-II : PARTIAL DIFFERENTIAL EQUATIONS – FIRST ORDER (9+3 Periods)

Formation of partial differential equations by elimination arbitrary constants and functions. Solutions to First order partial differential equations: Standard types of first order linear and non-linear PDE, Lagrange's linear PDE.

UNIT-III : PARTIAL DIFFERENTIAL EQUATIONS – HIGHER ORDER (9+3 Periods)

Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method. Separation of variables method: simple problems in Cartesian coordinates, Laplacian equation in plane, cylindrical nd spherical polar coordinates, one dimensional diffusion equation.

UNIT-IV : COMPLEX DIFFERENTIATION (9+3 Periods)

Functions of a Complex variable - Analytic functions - Cauchy Riemann equations and sufficient conditions (excluding proof) - Harmonic and orthogonal properties of analytic functions - Construction of analytic functions – Conformal mappings: w=z+a, az, 1/z, z^2, e^z,cosz, sinz and Bilinear transformations.

UNIT-V: COMPLEX INTEGRATION (9+3 Periods)

Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's theorems (Statements only) and expansions - Poles and Residues - Cauchy's Residue theorem - Contour integration: Circular and semicircle contours with no pole on real axis.

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS:

1. *Veerarajan T., **Engineering Mathematics (for first year)**, Tata McGraw-Hill, New Delhi,2008.*
2. *Srimanta Pal and suboth.C.Bhunia, **Engineering Mathematics**, Oxford university publications, New Delhi, 2015.*

REFERENCE BOOKS:

1. *B.S.Grewal, **"Higher Engineering Mathematics"**, Khanna Publishers, 43rd Edition,2015.*
2. *Erwinkreyszig, **"Advanced Engineering Mathematics"**,9th Edition, John Wiley&Sons, 2006.*
3. *N.P. Bali and Manish Goyal, **"A text book of Engineering Mathematics"**, Laxmi Publications, Reprint, 2008.*
4. *E. A. Coddington, **"An Introduction to Ordinary Differential Equations"**, Prentice Hall India, 1995.*
5. *G.F. Simmons and S.G. Krantz, **"Differential Equations"**, Tata McGraw Hill, 2007.*
6.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Develop the general solutions to higher order differential equations and power series solutions to second order differential equations leading to Bessel and Legendre functions.
CO2: Analyze first order partial differential equations.
CO3: Examine the techniques of solving second order partial differential equations and solutions by method of separation of variables.
CO4: Describe the properties of analytic function, formation of analytic function and mappings of standard functions, Mobius transformation.
CO5: Evaluate contour integration using calculus of residues

COURSE ARTICULATION MATRIX

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
CO2	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
CO3	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
CO4	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
CO5	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-
18CBS202	H	L	L	-	-	-	-	-	-	-	-	M	L	-	-	-

L – Low, M – Moderate (Medium), H- High

18CBS203	MECHANICS AND PROPERTIES OF SOLIDS *(Common to Civil & IBT Branches)*	SEMESTER II

Category: BS

PRE-REQUISITES: NIL

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

To enhance the fundamental knowledge in mechanics and properties of solids, and its applications relevant to their field of engineering. Upon completion of this course the students will be familiar with:

- Mechanics and Elastic behaviour of solids
- Thermal conduction and applications
- Principles of acoustics, ultrasonics and their industrial applications.
- Origin of quantum physics, Schrödinger's equation and applications.
- Emerging materials and their applications

UNIT-I : MECHANICS OF SOLIDS (9+3 Periods)

Elasticity- Hooke's law-Types of strain-Classification of Modulus of Elasticity- Poisson's Ratio - Stress-Strain diagram - Factors affecting elasticity – Moment, Couple and Torque – Derivation of Twisting Couple on a Cylinder (or wire) - Bending moment –Young's modulus by Non Uniform Bending - Depression of a cantilever - Uniform bending - I shaped girders.

UNIT-II : THERMAL PROPERTIES (9+3 Periods)

Thermal Conductivity – Thermal Diffusivity - Specific Heat Capacity - Rectilinear Flow of Heat along a Uniform Bar - heat conduction in solids - flow of heat through compound media (parallel and perpendicular) – Determination of Thermal Conductivity of a Good Conductor by Forbe's Method: theory and experiment - Determination of Thermal Conductivity of a poor Conductor by Lee's Disc Method: theory and experiment.

UNIT-III : ACOUSTICS & ULTRASONICS (9+3 Periods)

Classification of sound - loudness and intensity - Weber-Fechner law - standard intensity and intensity level - decibel - reverberation - reverberation time - Determination of absorption coefficient - factors affecting acoustics of buildings.

Introduction - properties of ultrasonic waves - production of ultrasonic waves; Magnetostriction effect- Magnetostriction generator- Piezoelectric effect- Piezoelectric generator- Acoustic grating - Determination of wavelength and velocity of ultrasonics- applications- ultrasonic drilling- ultrasonic welding- ultrasonic -Non- destructive Testing- Pulse echo system

UNIT-IV : QUANTUM MECHANICS AND APPLICATIONS (9+3 Periods)

Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation- de-Broglie wavelength in terms of voltage, energy and temperature –Heisenberg's Uncertainty principle – verification – physical significance of a wave function- Schrödinger's Time independent and Time dependent wave equations –- Particle in a one dimensional potential well.

UNIT-V : MODERN ENGINEERING MATERIALS (9+3 Periods)

Metallic glasses- preparation of metallic glasses - properties – applications of the metallic glasses - Shape Memory Alloys (SMA) - Characteristics, properties of NiTi alloy - applications of SMA - advantages and disadvantages of SMA - Nanomaterials-synthesis –chemical vapour deposition – Sol Gel – ball Milling – properties of nanoparticles and applications of nanoparticles.

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS:

1. *S. H. Crandall, N. C. Dahl & T. J. Lardner, "**An Introduction to the Mechanics of Solids"**, 2nd ed. with SI Units. – Unit I& II*
2. *P.K.Palanisamy-**Engineering Physics-I,** Scitech publications (India) pvt. Ltd., 3 edition, 2015. – Unit I, II & III*

REFERENCE BOOKS:

1. *J. L. Meriam,**"Engineering Mechanics: Statics"**, 7th ed. – Unit I& II*
2. *Arumugam M- **"Engineering Physics"**, Anuradha Publishers, 2010.– Unit IV*
3. *EP Popov, **"Engineering Mechanics of Solids**"*
4. *Avadhanulu M. N. and Kshirsagar P. G., **"A Textbook of Engineering Physics"**, S.Chand and Company Ltd, New Delhi, 2010.*
5. *Dr. Jayakumar .S, "**Materials Science", R. K. Publishers, 2008. -– Unit V***

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Explain solid mechanics and properties of matter with its applications.

CO2: Illustrate the concept of thermal physics. [Application]

CO3: Summarize acoustics of building and generation and application of ultrasonic waves.

CO4: Analyze the dual nature of matter using Heisenberg's Uncertainty principle, Schrodinger's time independent and dependent wave equations. [Assessment]

CO5: Describe the properties and applications of modern engineering materials. [Familiarity & Application]

COURSE ARTICULATION MATRIX:

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L	--	L	--	--	--	--	--	--	L	M	--	L	L
CO2	H	M	M	--	L	--	--	--	--	--	--	L	L	--	L	L
CO3	H	M	M	--	M	--	--	--	--	--	--	L	M	L	M	M
CO4	H	L	L	--	--	--	--	--	--	--	--	L	--	--	--	L
CO5	H	M	H	M	M	--	--	--	--	--	--	L	M	L	M	M
18CBS203	H	M	H	M	M	--	--	--	--	--	--	L	M	L	M	M

L-Low, M-Moderate (Medium), H-High

18CES204	PROGRAMMING IN C *(Common to all branches except Mech.& Prodn. branches)*	SEMESTER II

Category: ES

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- The Computer and Programming fundamentals.
- Data types in C and Flow control statements.
- Functions, Arrays, Pointers and Strings.
- Bitwise Operators, Preprocessor Directives, Structures and Unions.
- Structures, List Processing, Input and Output.

UNIT-I : COMPUTER AND PROGRAMMING FUNDAMENTALS (9 Periods)

Computer fundamentals – Evolution, classification, Anatomy of a computer: CPU, Memory, I/O – Introduction to software – Generation and classification of programming languages – Compiling – Linking and loading a program – Translator – loader – linker – develop a program – software development – Introduction to OS –Types of OS – Algorithms – Structured programming concept.

UNIT-II : DATA TYPES AND FLOW OF CONTROL (9 Periods)

An overview of C – Programming and Preparation – Program Output – Variables – Expressions, and Assignment, The use of #include, printf(), scanf() – Lexical elements, operators and the C systems – The fundamental data types – Flow of control

UNIT-III : FUNCTIONS, ARRAYS, POINTERS AND STRINGS (9 Periods)

Functions and storage classes - 1D Arrays – Pointers – Call by reference – Relationship between Arrays and Pointers – Pointer arithmetic and element size – Arrays as function argument – Dynamic memory allocation – Strings – String handing functions – Multidimensional Arrays.

UNIT-IV : ARRAY OF POINTERS, BITWISE OPERATORS, PREPROCESSOR DIRECTIVES (9 Periods)

Arrays of Pointers – Arguments to main () - Ragged Arrays – Functions as Arguments – Arrays of Pointers to Functions - Type qualifiers.-Bitwise operators and expressions – Masks – Software tools – Packing and unpacking – Enumeration types – The preprocessor directives.

UNIT-V : STRUCTURES AND UNIONS, I/O AND FILE OPERATIONS (9 Periods)

Structures and Unions – Operator precedence and associativity – Bit fields – Accessing bits and bytes - Input and Output functions – File Processing Functions – Environment variables – Use of make and touch.

Contact Periods:
Lecture: 45 Periods Tutorial:0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Pradip Dey, Manas Ghosh,* ***"Computer Fundamentals and Programming in C",*** *Second Edition, Oxford University Press, 2013.*
2. *Al Kelley, Ira Pohl,* ***"A Book on C-Programming in C",*** *Fourth Edition, Addison Wesley, 2001.*

REFERENCE BOOKS:

1. *Stephen G. Kochan,* ***"Programming in C-A complete introduction to the C programming language",*** *Third Edition, Sams Publication, 2004.*
2. *Yashavant P. Kanetkar,* ***"Let Us C",*** *13th edition, BPB Publications, 2013.*
3. *Brian W. Kernighan and Dennis Ritchie,* ***"The C Programming Language",*** *Second Edition, Prentice Hall Software Series, 1988.*
4. *Stephen Prata,* ***"C Primer Plus",*** *Fifth Edition, Sams Publishing, 2005.*

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Articulate the programming environment [Familiarity]
CO2: Write algorithm for solving the given problem statement [Usage]
CO3: Choose right data types and flow control statements [Assessment]
CO4: Write programs using functions, arrays, pointers and strings [Usage]
CO5: Assess right storage classes, preprocessor directives, bitwise operators in programs [Assessment]
CO6: Practice structures, unions and files [Usage]

COURSE ARTICULATION MATRIX:

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	H	H	--	M	M	M	M	L	M	--	--	L	L
CO2	H	H	M	H	H	--	--	M	M	M	L	M	--	--	M	M
CO3	H	H	M	H	H	--	--	M	M	M	L	M	--	--	--	L
CO4	H	H	M	H	H	--	--	M	M	M	L	M	--	--	--	--
CO5	H	H	M	H	H	--	--	M	M	M	L	M	--	--	--	--
CO6	H	H	M	H	H	--	--	M	M	M	L	M	--	--	--	--
18CES204	H	H	M	H	H	--	M	M	M	M	L	M	--	--	--	--

L-Low, M-Moderate (Medium), H-High

18CBS205	PHYSICS LABORATORY *(Common to all Branches)*	SEMESTER II

Category: BS

PRE-REQUISITES: NIL

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

To improve the basic knowledge in Physics and its applications relevant to various streams of Engineering and Technology. Upon completion of this course the students will be familiar with:

* To have a practical knowledge about the concepts of physics and its applications in the emerging fields of engineering and technology.

LABORATORY EXPERIMENTS

1. Spectrometer - Diffraction Grating Normal Incidence Method
2. Air Wedge –Determination thickness of a paper
3. Young's Modulus – Cantilever Bending Koenig's Method
4. a) Laser - Particle size Determination
   b) Optical fiber - Determination of NA & Acceptance angle
5. Ammeter and Voltmeter Calibration – Low Range
6. Determination of Bandgap Energy of Semiconductor
7. Ultrasonic Interferometer - Velocity of sound & Compressibility of liquids.
8. Torsional pendulum –Determination of Rigidity Modulus & Moment of Inertia

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

Upon the completion of the course, the student will be able to

CO1: Determine all physical properties of any matter,
CO2: Examine electrical measuring instruments and thereby effectively using it for particular application.
CO3: Apply principle of Laser diffraction and its application in particle size determination
CO4: Visualize the concept of light propagation through optical fibers and determination of its Parameters.
CO5: Determine the Intrinsic characteristic features of electronic devices for electrical and electronic applications.
CO6: Estimate the ultrasonic wave propagation in liquids and the determination of compressibility of liquids for engineering applications.

COURSE ARTICULATION MATRIX:

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L	L	M	--	--	--	--	--	--	L	M	M	M	--
CO2	H	M	L	M	L	--	--	--	--	--	--	L	M	M	M	--
CO3	H	M	L	L	--	--	--	--	--	--	--	L	L	--	--	--
CO4	H	M	M	L	M	--	--	--	--	--	--	L	L	M	M	--
CO5	H	M	M	L	M	--	--	--	--	--	--	L	M	L	L	--
CO6	H	M	M	M	M	--	--	--	--	--	--	M	M	M	M	--
18CBS205	H	M	M	M	M	--	--	--	--	--	--	L	M	M	M	--

L-Low, M-Moderate (Medium), H-High

18CES206	WORKSHOP PRACTICE *(Common to all Branches)*	SEMESTER II

Category: ES

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

L	T	P	C
1	0	4	3

- To make various basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail joint, Mortise & Tenon joint and Cross-Lap joint.
- To make various welding joints such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint.

LIST OF EXPERIMENTS

1. Introduction to use of tools and equipments in Carpentry, Welding, Foundry and Sheet metal
2. Safety aspects in Welding, Carpentry and Foundry
3. Half lap Joint and Dovetail Joint in Carpentry
4. Welding of Lap joint, Butt joint and T-joint
5. Preparation of Sand mould for cube, conical bush, pipes and V pulley
6. Fabrication of parts like tray, frustum of cone and square box in sheet metal
7. Electrical wiring – simple house wiring
8. Plumbing
9. CNC Machines demonstration and lecture on working principle.
10. Additive manufacturing demonstration and lecture on working principle.

Contact Periods :

Lecture: 15 Periods **Tutorial: 0 Periods** **Practical: 60 Periods** **Total: 75 Periods**

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO 1: Create basic joints using tools and equipment's used in Carpentry, Welding, Foundry and Sheet metal

CO 2: Prepare sand mold for various basic pattern shapes.

CO 3: Reproduce parts like tray, frustum of cone and square box in sheet metal.

CO 4: Practice minor works/repair related to electrical wiring and plumbing.

CO 5: Demonstrate the working of CNC machines and additivemanufacturing.

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	--	L	--	L	--	--	--	L	--	--	--	L	--	--	--
CO2	H	--	L	--	L	--	--	--	L	--	--	--	L	--	--	--
CO3	H	--	L	--	L	--	--	--	L	--	--	--	L	--	--	--
CO4	H	--	L	--	M	--	--	--	L	--	--	--	L	--	--	--
CO5	H	--	L	--	H	--	--	--	L	--	--	--	L	--	--	--
18CES206	H	--	L	--	M	--	--	--	L	--	--	--	L	--	--	--

L-Low, M-Moderate (Medium), H-High

18CES207	**PROGRAMMING IN C LABORATORY** *(Common to all Branches except Mech.& Prodn. Branches)*	**SEMESTER II**

Category: ES

PRE-REQUISITES: NIL

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- Data types in C and Flow control statements
- Functions, Arrays, Pointers And Strings
- Dynamic memory allocation and command line arguments
- Bitwise Operators, Preprocessor Directives, Structures and Unions
- Structures, List Processing, Input and Output

PRACTICALS :

EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:

1. Operators , Expressions and IO formatting
2. Decision Making and Looping
3. Arrays and Strings
4. Functions and Recursion
5. Pointers
6. Dynamic Memory Allocation
7. Structures
8. Unions
9. Files
10. Command line arguments
11. Mini Project

Contact Periods :

Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

- CO1: Identity appropriate data types and flow control statements [Usage]
- CO2: Develop programs using functions, arrays, pointers and strings [Usage]
- CO3: Develop programs using dynamic memory allocation [Usage]
- CO4: Create programs using right storage classes, preprocessor directives, bitwise operators [Usage]
- CO5: Practice command line arguments, structures, unions and files [Usage]
- CO6: Develop applications using C [Usage]

COURSE ARTICULATION MATRIX:

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	H	H	--	--	M	M	M	L	M	--	--	--	--
CO2	H	H	M	H	H	--	--	M	M	M	L	M	--	--	--	--
CO3	H	H	M	H	H	--	--	M	M	M	L	M	--	--	L	--
CO4	H	H	M	H	H	--	--	M	M	M	L	M	--	--	L	--
CO5	H	H	M	H	H	--	--	M	M	M	H	H	--	--	--	--
CO6	H	H	M	H	H	--	--	M	M	M	M	M	--	--	--	H
18CES207	H	H	M	H	H	--	--	M	M	M	M	M	--	--	--	--

L-Low, M-Moderate (Medium), H-High

18CBS301 **TRANSFORM CALCULUS AND PARTIAL DIFFERENTIAL EQUATIONS** **SEMESTER III**

(Common to Civil and IBT Branches)

Category : BS

L	T	P	C
3	1	0	4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart the knowledge of construction of Fourier series.
- To acquire knowledge of techniques to solve one dimensional partial differential equationsconcerning to engineering applications.
- To be familiar with concept and applications of Laplace, Fourier and Z transforms.

UNIT – I : FOURIER SERIES (9 Periods)

Dirichlet's Conditions – General Fourier series – Odd and even functions- Half range Sine and Cosine series – Parseval's Identity on Fourier series–Harmonic Analysis

UNIT – II : BOUNDARY VALUE PROBLEMS (9 Periods)

Classification of partial differential equations – Method of separation of variables–One dimensional wave equation – One dimensional heat equation– Transient and Steady state conditions–Fourier series solution.

UNIT – III : LAPLACE TRANSFORMS (9 Periods)

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Initial and Final value theorems, Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transform method.

UNIT – IV : FOURIER TRANSFORMS (9 Periods)

Statement of Fourier integral Theorem – Fourier transform pair – Fourier Sine and Cosine Transforms – Properties – Transforms of Simple functions – Convolution Theorem – Parseval's Identity – Finite Fourier transforms.

UNIT – V : Z TRANSFORMS (9 Periods)

Z-transforms - Elementary properties - Inverse Z-transforms - Initial and Final value theorems - Convolution theorem – Formation of difference equations - Solution to difference equations of second order with constant coefficients using Z- transform

Contact Periods: Lecture: 45 Tutorial: 15 Practical: 00 Total : 60 Periods

TEXT BOOKS:

1 *Veerarajan. T.,**"Transforms and partial Differential equations"**, Tata Mc Graw Hill Publishing Co., New Delhi. 2015*.

REFERENCE BOOKS:

1 *B.S.Grewal.,**"Higher Engineering Mathematics"**, Khanna Publishers, New Delhi,44rd Edition, 2018.*
2 *Kandasamy, Thilagavathy and Gunavathy., **"Engineering Mathematics"** for III Semester, S.Chand &Co, Ramnagar, New Delhi.*
3 *N.P.Bali and Manish Goyal., **"Transforms and partial Differential equations"**, University Science Press, New Delhi, 2010.*
4 *Veerarajan T., **"Engineering Mathematics"** for Semester I & II, Tata McGraw Hill Education (India) Pvt Ltd., New Delhi, Third Edition 2012.*
5 *Erwinkreyszig, **"Advanced Engineering Mathematics"**, 9th Edition, John Wiley & Sons, 2006.*

COURSE OUTCOMES:

On completion of this course, Students will be able to

CO1: Describe the concepts of Fourier series and its construction when discrete and continuous form is known.
CO2: Solve boundary value problems.
CO3: Utilize Laplace transforms in solving Differential equations.
CO4: Apply Fourier transforms in order to solve improper integrals.
CO5: Identify the Z transform methods to find solutions of difference equations.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	L	L	L		M				H	L	M	H	
CO2	H	H				L					H	H		M	H	
CO3	H	H			M	L		L	H		H	H	L	H	H	
CO4	H	H			M	L			H		H	M		M	H	
CO5	M	M			M	L		M				M	L		M	
18CBS 301	H	H	H	L	M	L		M	H		H	H	L	M	M	

L-Low, M-Moderate (Medium), H-High

18CES302	ENGINEERING MECHANICS FOR CIVIL ENGINEERS	SEMESTER III

Category : ES

L	T	P	C
3	1	0	4

PRE-REQUISITES:

1 18CBS102 - Calculus and Linear Algebra
2 18CBS202 - Differential Equations and Complex Variables
3 18CBS203 - Mechanics and Properties of Solids

COURSE OBJECTIVES:

* To analyze the force systems, friction, equilibrium of particles.
* To Know the Kinematics and kinetics.
* To study the dynamics of particles, impulse and momentum Principles.

UNIT – I : BASIC CONCEPTS OF FORCES (9 Periods)

Basic Concepts and Principles of Forces– Laws of Mechanics – system of forces in Plane – Free body Diagrams- resultant of a force system – resolution and composition of forces – Lami's theorem – moment of a force – physical significance of moment-Varignon's theorem – resolution of a force into force and couple – forces in space – addition of concurrent forces in space – equilibrium of a particle in space.
Analysis of plane Trusses by Method of Joints & Method of Sections

UNIT – II : STATIC AND DYNAMIC FRICTION (9 Periods)

Frictional resistance – classification of friction- laws of friction – coefficient of friction-angle of friction – angle of repose — cone of friction –advantages-equilibrium of a body on a rough inclined plane – non-concurrent force system - ladder friction – rope friction – wedge friction - screw jack & differential screw jack.

UNIT – III : PROPERTIES OF SECTION (9 Periods)

Centroid and Centre of Gravity for simple & Composite sections– Determination by First principle – moment of inertia – theorems of moment of inertia –Product of Inertia – Principal moment of inertia of plane areas - Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook

UNIT – IV : BASICS OF DYNAMICS - KINEMATICS (9 Periods)

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

UNIT – V : BASICS OF DYNAMICS - KINETICS (9 Periods)

Newton's second law of motion – linear momentum – D'Alembert's principle, Dynamics equilibrium — work energy equation of particles– law of conservation of energy – principle of work and energy - Principle of impulse and momentum – Equations of momentum – Laws of conservation of momentum. Impact – Time of compression, restitution, collision – Co-efficient of restitution – types of impact – collision of elastic bodies by direct central impact and oblique impact – collision of small body with a massive body – Kinetic energy of a particle.

Contact Periods: Lecture: 45 Tutorial: 15 Practical: 00 Total : 60 Periods

TEXT BOOKS:

1 *F.B. Beer and E.R. Johnson, **"Vector Mechanics for Engineers"**, Tata Mc.Graw Hill Pvt Ltd, 11th Edition, 2013.*

2 *Khurmi R.S. & N.Khurmi **"A Text Book of Engineering Mechanics"**, S. Chand & Co.22nd Edition , 2018.*

3 *Bansal R.K, **"A Text Book of Engineering Mechanics"**, Laxmi Publications, 2015.*

REFERENCE BOOKS:

1 *Rajasekaran& Sankara Subramanian, **"Fundamentals of Engineering Mechanics"**, 3rd Edition, 2017.*

2 *S. Timoshenko and Young, **"Engineering Mechanics"**, McGraw Hill, 4th Edition, 2017.*

3 *Irving Shames and Krishna Mohana Rao, **"Engineering Mechanics"**, Prentice Hall of India Ltd, Delhi, 4th Edition, 2005.*

4 *R.C. Hibbeller, **"Engineering Mechanics"**, Prentice Hall of India Ltd, 14th Edition, 2017.*

5 *Domkundwar V.M and Anand V. Domkundwar, **"Engineering Mechanics" (Statics and Dynamics)**, Dhanpat Rai and Co. Ltd, 4thEdition, 2005.*

COURSE OUTCOMES:

On completion of this course, Students will be able to

CO1: Recall the principles and Concepts of Mechanics.
CO2: Interpret the concepts and solve problems in friction.
CO3: Determine the centre of gravity and moment of inertia for different sections.
CO4: Apply the concepts of Kinematics for solving problems.
CO5: Apply the concepts of Kinetics for solving problems

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	L	--	--	M	--	--	--	--	--	--	--	H	H	--
CO2	H	M	L	--	--	--	--	--	--	--	--	L	--	H	H	--
CO3	H	H	L	--	--	--	--	--	--	--	--	--	--	H	H	--
CO4	H	H	L	--	--	--	--	--	--	--	--	L	--	H	H	--
CO5	H	H	L	--	--	--	--	--	--	--	--	L	--	H	H	--
18CES 302	H	H	L	--	--	M	--	--	--	--	--	L	--	H	H	--

L-Low, M-Moderate (Medium), H-High

18CPC303	STRENGTH OF MATERIALS	SEMESTER III

Category : PC

L	T	P	C
3	1	0	4

PRE-REQUISITES:

1 18CBS102 Calculus and Linear Algebra
2 18CBS202 Differential Equations and Complex Variables
3 18CBS203 Mechanics and Properties of Solids

COURSE OBJECTIVES:

* To learn the basics of shear and bending stresses and evaluate complex stress problems.
* To understand the behaviour of beams in bending and twisting.
* To impart knowledge on different methods of finding deflection of beam.
* To get the concepts on analysis of stresses in cylinders and columns.

UNIT -I : SIMPLE AND COMPLEX STRESSES (9 Periods)

Simple Stresses: Axial Members - Deformation, strain, simple stress, Principle of superposition - Elastic constants - Compound Bars – Thermal Stresses – Stresses due to pure Shear.
Compound Stresses: Two mutually Perpendicular direct stresses – Principal Planes and Principal Stresses –Two-Dimensional Stress System – Graphical method – Mohr's circle – Combined bending and torsion – Analysis of strain – Principal Strains and Direction.

UNIT- II: BEAMS (9 Periods)

Beams under bending: Beams and Bending – supports and loads - Shear Force and Bending Moment Diagrams for determinate beams – Relationship between rate of Loading, Shear Force and Bending Moment – Point of Contra Flexure.
Bending and shear stresses: Bending Stress – Combined Direct and Bending Stresses - Shearing stress – Flitched Beams.

UNIT- III: TORSION AND CYLINDERS (9 Periods)

Torsion: Torsion of Circular and Hollow Shafts –Elastic Theory of Torsion - Stresses and Deformation in Circular Solid and Hollow Shafts – Stepped Composite Shafts – Combined Bending Moment and Torsion on Shafts – Strain Energy due to Torsion –Power Transmitted to a Shaft – Shafts in Series and Parallel –Closed and Open .
Thin Cylinders: Hoop and Longitudinal stresses – Volumetric Strain.

UNIT -IV: DEFLECTION OF BEAMS AND UNSYMMETRICAL BENDING (9 Periods)

Deflection of beams: Deflection Curve – Differential Equation – Double Integration Method – Macaulay's Method – Area Moment Method (Stepped Beams) – Conjugate Beam Method.
Unsymmetrical Bending: Product of Inertia – Stresses due to Unsymmetrical Bending – Shear Centre – Definition – Shear Centre for Symmetrical and Unsymmetrical Sections.

UNIT -V: COLUMNS AND THEORIES OF ELASTIC FAILURE (9 Periods)

Columns: Theory of Columns. - eccentric load – Slenderness Ratio – End Conditions – Buckling Load for Columns- Euler's Theory – Assumptions and Limitations – Rankine's Formula – Combined bending and axial load.
Theories of Elastic Failure: Failure theories – Factor of Safety – Graphical Representation of Theories for Two Dimensional Stress System.

Contact Periods: Lecture: 45 Tutorial: 15 Practical: 00 Total: 60 Periods

TEXT BOOKS:

1. *Sadhu Singh, **"Strength of Materials"**, Khanna publishers, New Delhi, 2013.*
2. *Vaidyanathan.R, Perumal.P and Lingeswari.S, **"Mechanics of Solids and Structures, Volume I"**, Laxmi Publications Pvt Ltd, Chennai, 2017.*
3. *Rajput.R.K, **"Strength of Materials"**, S. Chand & Co., New Delhi, 2015.*
4. *L. S. Negi, **"Strength of Materials"**, Tata Mc Graw Hill Education Pvt. Ltd, 2010*
5. *https://nptel.ac.in/courses/105105108/5*

REFERENCE BOOKS:

1. *Prasad.I.B, **"Strength of Materials"**, Khanna Publishers, New Delhi, 2006*
2. *Robert L.Mott, **"Applied Strength of Materials"**, PHI Learning Pvt Ltd.," New Delhi,2009*
3. *Jhunarkar.S.B. and Shah.H.J, **"Mechanics of Structures", Vol. I**, Charotar Publishing House, NewDelhi, 2016.*
4. *L.S. Srinath, **"Strength of Materials",** Macmillan Publishers India,2000*
5. *Bansal R K **"Strength of Materials"**, Laxmi Publications, New Delhi, 2010.*
6. *Daniel Schodek and Martin Bechthold, **"Structures"**, Pearson India Education Services Pvt Ltd, 2015*
7. *Ferdinand Beer, E.Russell Johnston and John Dewolf, **"Mechanics of Materials"**, Mc Graw Hill Education, 2015*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Describe the fundamental concepts of stress, strain and principal stresses.

CO2: Plot shear force and bending moment diagrams and determine bending and shear stress distribution in beams.

CO3: Analyze the shaft subjected to twisting.

CO4: Determine the deflection of beams.

CO5: Identify the stresses in cylinders, behavior of colums and theory of elastic failures.

COURSE ARTICULATION MATRIX :

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	L	L	M							L	M	H	L
CO2	H	H	M	L	L				L					M	M	L
CO3	H	M	L		M				L					M	H	L
CO4	H	H	L		H				L					M	M	
CO5	H	M	M	M	L				L					M	M	
18CPC 303	H	H	M	L	L	L			L				L	M	H	L

L-Low, M-Moderate (Medium), H-High

18CPC304 **MECHANICS OF FLUIDS** **SEMESTER III**

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CBS102 - Calculus and Linear Algebra
2 18CBS202 - Differential Equations and Complex Variables

COURSE OBJECTIVES:

* To impart the knowledge on properties and behaviour of fluid at static conditions.
* To understand the properties and behaviour of fluid at dynamic conditions.
* To Apply the static and dynamic concepts in solving various fluid flow problems

UNIT – I : BASIC CONCEPTS AND FLUID STATICS (9 Periods)

Dimensions and Units - Continuum Concept - CGS, MKS and SI systems – Properties of fluids - Density, specific gravity, viscosity, surface tension, capillarity, elasticity, compressibility, vapour pressure - Control Volume - Fluid statics – Pascal's Law - Pressure measurement - Piezometer and Manometers – Hydrostatic forces on plane and curved surfaces - Stability of floating bodies - Buoyancy – Metacentre and metacentric height - simple problems.

UNIT – II : PRINCIPLES OF MASS (9 Periods)

Methods of describing fluid motion – Classification of fluid flow – Stream line, path line and streak line – Continuity equation - one dimensional and three dimensional – Velocity – Acceleration of a fluid particle - tangential, normal, local and convective acceleration - Velocity potential and stream functions - Free and Forced vortex flow.

UNIT – III : PRINCIPLE OF ENERGY (9 Periods)

Energy and its forms, Energy equation – Euler's and Bernoulli's equation – Applications -Venturimeter, Orifice meter and Pitot tube - Flow over Notches and Weirs.

UNIT – IV : FLOW THROUGH CONDUITS (9 Periods)

Laminar flow between parallel plates – laminar flow in pipes - Hagen Poiseuille equation for flow through circular pipes - Turbulent flow in pipes – Darcy - Weisbach formula for flow through circular pipes - Hydro dynamically smooth and rough boundaries, velocity distributions for turbulent flow in smooth and rough pipes - Moody diagram.

UNIT – V : BOUNDARY LAYER AND FLOW AROUND IMMERSED BODIES (9 Periods)

Concepts of Boundary layer - Definition - Boundary layer on a flat plate – Boundary layer thickness - Displacement, energy and momentum thickness - Boundary layer separation - Flow around immersed objects - Drag and lift on immersed bodies – Magnus effect.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *D.S.Kumar,* ***"Fluid Mechanics and Fluid Power Engineering"****, S.K.Kataria & Sons, New Delhi, 2012.*

2 *P.N.Modi and S.N.Seth,* ***"Hydraulics and Fluid Mechanics, Including Hydraulic Machines"****, Standard Book House, New Delhi, 2015.*

3 *R.K.Bansal,* ***"Fluid Mechanics and Hydraulic Machines"****, Laxmi Publications (P) Ltd., New Delhi, 2018.*

REFERENCE BOOKS:

1 *K.L.Kumar, "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi, 2018.*

2 *M.K.Natarajan "Principles of Fluid Mechanics", Anuradha Agencies, VidayalKaruppur, Kumbakonam, 2008.*

3 *Nagaratnam S., "Fluid Mechanics", Khanna Publishers, New Delhi 1995.*

4 *JagdishLal, "Hydraulics and Fluid Mechanics", Tata McGraw Hill, New Delhi , 2001.*

5 *R.K.Rajput, "A Text Book of Fluid Mechanics and Hydraulic Machines", S.Chand and Company, New Delhi,2015.*

COURSE OUTCOMES:

On completion of this course, Students will be able to

CO1: Identify the properties of fluids and fluid statics.

CO2: Apply the continuity equation for solving fluid flow problems.

CO3: Apply the principles of Euler's equation and Bernoulli's equation in real situation of fluid problems.

CO4: Examine the fluid flow behaviour for laminar and turbulent flows.

CO5: Analyze the boundary layer separation, drag and lift on immersed bodies.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H		M									L	H	H	
CO2	H	H	M	M									L	H	H	
CO3	H	H	M	M									L	H	H	
CO4	H	H		M		M	M						L	H	H	
CO5	H	H	M	M		L	L						L	H	H	
18CPC 304	H	H	M	M									L	H	H	

L- Low, M- Moderate (Medium), H- High

18CPC305	SURVEYING	SEMESTER III

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To understand basic principle and concepts of different surveying methods.
* To study the different surveying equipments in the field of civil engineering.
* To enhance the ability to calculate surveying quantities.

UNIT – I : INTRODUCTION, CHAIN SURVEYING AND COMPASS SURVEYING (9 Periods)

Definition- Principles - Classification – Field and Office work – Scales – Conventional Signs. Chain Survey - Instruments – Ranging – Types - Obstacles in Chaining – Chain and Tape corrections - Setting out Perpendiculars.
Prismatic Compass – Surveyor's Compass – Working and use of compass - Bearing – Systems and Conversions – Computation of angles from bearing - Local Attraction - Magnetic Declination – Dip – Traversing – Adjustment of error.

UNIT – II : LEVELLING AND CONTOURING (9 Periods)

Basic Terms - Types of Level – Fundamental Axes - Levelling staff – Bench Marks – Temporary and Permanent Adjustments – Types of Levelling - Curvature and Refraction correction - Reciprocal Levelling – Calculation of Areas and Volumes.
Contouring – Characteristics and Uses of Contours – Methods of contouring.

UNIT – III : THEODOLITE SURVEYING AND TACHEOMETRIC SURVEYING (9 Periods)

Theodolite – types – Terms - Temporary and Permanent Adjustments – Measurement of Horizontal Angles by Repetition and Reiteration – Closing Error and Distribution – Omitted Measurements
Tacheometric surveying – Methods-Determination of constants of the tacheometer-use of anallactic lens- distance and elevation formula for inclined sights with vertical and normal holding staff – movable hair method- principles of tangential tacheometry- subtense bar method.

UNIT – IV : CURVES AND HYDROGRAPHIC SURVEYING (9 Periods)

Simple curves - elements - Setting out of curves -Linear and angular methods - Difficulties in setting out - Compound and Reverse curves- elements - Setting out of Vertical Curves.
Shore line survey – Tides – Tide Gauges – types – Sounding – Equipments – Locating Sounding - Reduction- Route survey – Reconnaissance, Preliminary, Location and Construction survey.

UNIT – V : TRIANGULATION AND MODERN SURVEYING INSTRUMENTS (9 Periods)

Vertical and horizontal control-Triangulation-classification – Intervisibility - Triangulation Figures – Strength of figure - Signals and Towers - Base line measurements - Satellite stations and reduction to centre. Trignometrical Levelling - Geodetical observations: Terrestrial Refraction – Axis signal correction – Difference in elevation.
Total Station - Principle - classification - working. GPS - Developments - Basic Concepts - Segments - Receivers and methods - Applications.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Kanetkar .T.P, and Kulkarni .S.V, **"Surveying and Levelling, Vol. I & II"**, Pune VidyarthiGrihaPrakashan ,2014.*
2 *DuggalS.K **."Surveying ,Vol. I &II"**, Tata McGraw-Hill, Publishing Company, 2017.*
3 *Basak N.N, **"Surveying and Leveling"**, Tata McGraw-Hill, Publishing Company, 2nd edition, 2014.*
4 *Bhavikatti S.S, **"Surveying and Leveling ,Vol.I& II"**, I.K. International Pvt. Ltd., 2010.*
5 *Punmia B.C, Ashok kr. Jain, Arun kumarJain. **"Surveying, Vol. I &II"**, Lakshmi Publications, 2017.*

REFERENCE BOOKS:

1 *Charles D Ghilani, Paul R Wolf., **"Elementary Surveying"**, Prentice Hall, 2012.*
2 *Bannister. A &Stanley Raymond, Raymond Baker, **"Surveying"**, Pearson Education.*
3 *Chandra A.M., **"Plane Surveying"**, New Age International Pvt. Ltd, 2015.*

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Calculate linear and angular measurements using compass and chain
CO2: Interpret level data and plot contour maps
CO3: Determine the vertical, horizontal and angular measurements using theodolite.
CO4: Plot curves using survey instruments
CO5: Infer knowledge on modern surveying instruments.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	M	M	M				M	M	M			L	M	L
CO2	H	M	L	H	M				M	M	M			L	M	
CO3	H	M	H	M	M				M	M	M			L	M	
CO4	M	M	M	M	M				L	M	M			M	M	
CO5	M	M	L	M	M						L		L	M	M	
18CPC 305	H	M	H	H	M				M	M	M			M	M	

L-Low, M- Moderate (Medium), H- High

18CPC306	WATER SUPPLY ENGINEERING	SEMESTER III

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To make the students conversant with sources and its demand of water.
* To know the basic characteristics of water and Conveyance of Water.
* To expose the students to understand the design of water Treatment.
* To provide adequate knowledge about the advanced water treatment processes.
* To have adequate knowledge on Distribution of water supply.

UNIT – I : QUANTITY OF WATER AND SOURCES OF WATER (9 Periods)

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality..

UNIT – II : QUALITY OF WATER AND TRANSPORTATION (9 Periods)

Quality of water - sampling - Characterization – Significance -analysis of water - water borne diseases - quality standards of water. Intakes - types - intake tower - Transportation of water - types of conduits -Hydraulics of pipe flow - design - materials of pressure pipes - pipe corrosion - Theories, effect and prevention- Laying and testing of pipe lines. Pumps - Types of pumps - selection of pumps - pumping stations

UNIT – III : WATER TREATMENT (9 Periods)

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators, flash mixers, Coagulation and flocculation – Clarifloccuator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management – Construction, Operation and Maintenance aspects.

UNIT – IV : ADVANCED WATER TREATMENT (9 Periods)

Water softening - Desalination - R.O. Plant - demineralization – Adsorption - Ion exchange - Membrane Systems - RO Reject Management - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects – Recent advances.

UNIT – V : DISTRIBUTION OF WATER AND OF WATER SUPPLY (9 Periods)

Distribution of water - requirements of good distribution system - method of distribution system - layouts of distribution system - Requirements of water distribution – Components – Selection of pipe material – Service reservoirs – Functions – Network design – Economics – Analysis of distribution networks - Computer applications – Appurtenances – Leak detection. Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 Periods

TEXT BOOKS:

1 *Garg. S. K., **"Water Supply Engineering"**, Khannah Publishers, Delhi, 2014.*
2 *Mark J. Hammer, Mark J. Hammer Jr, **"Water and Waste Water Technology"**, Prentice hall of India 2008.*
3 *S. C. Rangwala and K. S. Rangwala, **"Water Supply and Sanitary Engineering"**, Charotar Publishing house 2012*
4 *Babbit. H. E., and Donald. J. J., **"Water Supply Engineering"**, McGraw Hill book Co, Delhi 2011*
5 *Punmia B.C, Jain A.K and Jain A.K, **"Water Supply Engineering"** Laxmi Publications, New Delhi 2014.*

REFERENCE BOOKS:

1 *Mackenzie L Davis., **"Water and Waste Water Engineering Design Principles and Practice"**, McGraw Hill book education, 2010.*
2 *Fair. G. M..,Geyer. J. C., **"Water Supply and Waste Water disposal"**, John Wiley & Sons, 2010.*
3 *Duggal. K.N., **"Elements of public Health Engineering"**, S.Chand and Co, 2007.*
4 *Metcalf and Eddy, **"Waste Water Engineering- Treatment and Reuse"** Tata Mc-Graw Hill Company, New Delhi 2007*
5 *NPTEL **"Water and Waste Water Engineering"** by Dr.P.Bose , IIT Kanpur*

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Calculate water demand and identify the sources of water.
CO2: Predict the quality of water as per water quality standards.
CO3: Design various water treatment units.
CO4: Identify the advanced water treatment methods
CO5: Analyze the water distribution network

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H		L		L	M					L	L	M	L	M
CO2	H	H		M		L	M					L	M	M	L	M
CO3	H	H	M				L					L	M	M	M	M
CO4	H	H	M	M			L					L	M	M	L	M
CO5	H	H	L	M		L	M					L	M	M	L	M
18CPC 306	H	H	M	M		L	M					L	M	M	L	M

L-Low, M-Moderate (Medium), H-High

18CMC3Z7	CONSTITUTION OF INDIA *(Common to all Branches)*	SEMESTER III

Category : MC

L	T	P	C
3	0	0	0

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To know about Indian constitution.
* To know about central and state government functionalities in India.
* To know about Indian society.

UNIT – I : INTRODUCTION (9 Periods)

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Role of the Election Commission.

UNIT – II : STRUCTURE AND FUNCTION OF CENTRAL AND STATE GOVERNMENT (9 Periods)

Union Government – Structures of the Union Government and Functions – President – Vice President– Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review. State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT – III : CONSTITUTION FUNCTIONS OF INDIA AND INDIAN SOCIETY (9 Periods)

Indian Federal System – Central – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.
Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

UNIT – IV : POLICIES AND ACTS - GENERAL (9 Periods)

Insurance and Bonding – Laws Governing Sale, Purchase and use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax , Excise and Custom duties and their Influence on Construction Cost – Legal Requirements for Planning – Property Law– Agency Law – Local Government Laws for Approval.

UNIT – V : POLICIES AND ACTS ON INFRASTRUCTURE DEVELOPMENT (9 Periods)

A Historical Review of the Government Policies on Infrastructure – Current Public Policies on Transportations – Power and telecom Sector – Plans for Infrastructure Development – Legal framework for Regulating Private Participation in Roads and Highways – Ports and Airport and Telecom

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total:45 Periods

TEXT BOOKS:

1 *Durga Das Basu, **"Introduction to the Constitution of India"**, Prentice Hall of India, New Delhi,2018*
2 *R.C.Agarwal, **"Indian Political System"**, S.Chand and Company, New Delhi,2004.*
3 *Maciver and Page, **"Society: An Introduction Analysis"**, Mac Milan India Ltd., New Delhi,2007*
4 *K.L.Sharma,**"Social Stratification in India: Issues and Themes"**, Jawaharlal Nehru University, New Delhi,2006*

REFERENCE BOOKS:

1 *M.Laxmikanth, **"Indian Polity"**, Mcgraw Hill Education (India)Private limited,2016*
2 *Sharma, Brij Kishore, **"Introduction to the Constitution of India"**, Prentice Hall of India, New Delhi,2018*

COURSE OUTCOMES:

On completion of the course, the students will able to

CO1: Paraphrase and abide the rules of the Indian constitution.
CO2: Outline the functions of Central government.
CO3: Demonstrate the function of state government.
CO4: Discover the various constitutional functions.
CO5: Generalize the different culture among the people of India.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1						M	M	L				M			L	
CO2						L		L				M		L		
CO3						L		L				M				
CO4						L						L		L		
CO5						L	L					L		L	L	
18CMC 3Z7						L	L					M		L	L	

L-Low, M-Moderate (Medium), H-High

18CPC308 **SURVEY LABORATORY** **SEMESTER III**

Category : PC

L	T	P	C
0	0	3	1.5

PRE-REQUISITES: NIL

1. 16CPC305 –Surveying

COURSE OBJECTIVES:

- To enhance the ability to measure different surveying measurements.
- To apply suitable surveying methods and instruments for a given problem.
- To equip the handling and measure by advanced surveying equipments.
- To enable to setting out the curves

LIST OF EXPERIMENTS

1. Chain Surveying – Open and Closed Traversing
2. Compass Surveying – Intersection method
3. Compass Surveying - Traversing
3. Plane table surveying -Introduction- Intersection method
4. Levelling –Differential Levelling and Fly Levelling
5. Measurement of horizontal angles by Repetition and Reiteration methods.
6. Height and Distance – Single Plane method and Double Plane method.
7. Tacheometric Surveying – Stadia, Tangential method and Subtense bar method
8. Total Station Surveying.
9. Setting out of Curves

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 45 Total :45 Periods

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Handle the surveying instruments like Chain, Compass, Plane table and Dumpy level.
CO2: Measure distances, Areas, angles and levels
CO3: Calculate the levels and distances
CO4: Set out curves.
CO5: Handle and measure by the advanced surveying instruments like total station.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	--	L	H	--	--	--	--	--	--	--	--	H	M	L	--
CO2	M	--	L	H	--	--	--	--	--	--	--	--	H	L	L	--
CO3	M	--	L	H	--	--	--	--	--	--	--	--	H	L	L	--
CO4	M	--	L	H	--	--	--	--	--	--	--	--	H	M	L	--
CO5	M	--	L	H	--	--	--	--	--	--	--	--	H	M	L	--
18CPC 308	M	--	L	H	--	--	--	--	--	--	--	--	H	M	L	--

L-Low, M- Moderate (Medium), H- High

18CPC309	MATERIALS TESTING LABORATORY	SEMESTER III

Category : PC

L	T	P	C
0	0	3	1.5

PRE-REQUISITES: NIL

1 18CBS203 Mechanics and Properties of Solids
2 18CPC303 Strength of Materials

COURSE OBJECTIVES:

- To find the strength properties of different construction materials like steel, concrete, brick and timber
- To evaluate stiffness properties of springs.
- To find the hardness properties of various metals.

LIST OF EXPERIMENTS

1. Tension test on mild steel rod.
2. Tension test on tor steel rod.
3. Torsion test on mild steel bar.
4. Tension and compression test on springs.
5. Compression test on bricks and concrete cubes.
6. Water absorption test on bricks.
7. Hardness test on different metals.
8. Compression and bending test on wood specimens.
9. Deflection test on simply supported beams (for different metals).
10. Deflection test on cantilever beams (for different metals).
11. Bending test on rolled steel joist
12. Flexure test on tiles
13. Charpy and Izod Impact Test
14. Double shear test

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 45 Total :45 Periods

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Determine the tensile strength of materials
CO2: Obtain bending properties of structural materials
CO3: Determine the hardness properties of the materials
CO4: Predict the compressive strength of the materials
CO5: Obtain the impact and torsional strength of the materials.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	L	L	L				M		M		H	M	L	
CO2	H	L	L	M					L		L		H	L	L	
CO3	H		L	H					M		M		H	L	L	
CO4	M		L	M					L		M		H	M	L	
CO5	H	L	L	H					L		M		H	M	L	
18CPC 309	H	L	L	H	L				L		M		H	M	L	

L-Low, M-Moderate (Medium), H-High

18CHS401	CIVIL ENGINEERING – SOCIETAL AND GLOBAL IMPACT	SEMESTER IV

Category : HS

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To impart the awareness of the importance of Civil Engineering and the impact it has on the Society and at Global levels.
* To know the importance of various Infrastructure Development Projects in Civil Engineering.
* To understand the concepts of Environmental Sustainability.

UNIT – I : INTRODUCTION (9 Periods)

Development of Pre-industrial revolution up to Industry4.0 – Construction4.0.
Modern Building Materials: Ceramic Materials – common ceramic materials & their characteristics – sintering and vitrification process – Ceramic structures – Composite materials – Types – Applications of laminar composites– Polymers matrix and their applications – Metal matrix – Ceramic matrix composites and their applications– Neoprene – Thermocole – Fibre Reinforced Plastics.

UNIT – II : INFRASTRUCTURE (9 Periods)

Importance, scope and role in different sectors of construction.
Highway Sector: Repayment of Funds – Toll Collection Strategy – Maintenance strategy – Review of toll rates & structuring to suit the traffic demand.
Irrigation Projects: Large / Small Dams - Instrumentation – Monitoring of water levels, catchments area – Rainfall data management, prediction – Land irrigation planning & policies, processes – Barrages, Canals.
Power Projects: Power scenario in India – Estimated requirement – Generation of Power distribution strategies – National grid – Load calculation & factors – Hydropower - day to day operations, management structures, maintenance – Nuclear Power.
Airports: Requisites of domestic, International, Cargo, Military airports – Facilities available – Terminal management – ATC.
Railways: Mass Rapid Transport System MRTS, LRT, Multi-modal Transport System.
Future Vision for Civil Engineering: Infrastructure – Habitats, Megacities, Smart Cities.

UNIT – III : ENVIRONMENTAL SUSTAINABILITY (9 Periods)

Ecosystems in Society and in Nature – the steady erosion in Sustainability – Evaluating future requirements for various resources – Solid waste management – Water purification – Wastewater treatment & Recycling, Hazardous waste treatment – Atmospheric pollution – Global warming, its impact and possible causes – Mitigation measures – Advanced construction techniques for better sustainability – Human Development Index and Ecological Footprint of India – Innovations and methodologies for ensuring Sustainability.

UNIT – IV : BUILT ENVIRONMENT (9 Periods)

Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy) – Built environment – Facilities management – Climate control – Energy efficient built environments and LEED & GRIHA ratings – Recycling – Temperature/ Sound control in built environment – Security systems – Intelligent/ Smart Buildings – Aesthetics of built environment – Role of Urban Arts Commissions.

UNIT – V : CIVIL ENGINEERING PROJECTS (9 Periods)

Environmental Impact Analysis procedures – Waste (materials, manpower, equipment) avoidance/ Efficiency increase – Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects – contribution of Civil Engineering to GDP – Innovations and methodologies for ensuring Sustainability during Project development.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Chandra, Prassanna,* ***"Projects, Planning, Analysis, Selection, Financing, Implementation and Review"****, Tata McGraw-Hill, New Delhi, 2006.*

2 *Kibert, C.* ***"Sustainable Construction: Green Building Design And Delivery"****, John Wiley & Sons, 4th Edition, 2016.*

REFERENCE BOOKS:

1 *Raghuram, G. & Jain, R.,* ***"Infrastructure Development & Financing Towards a Public-Private Partnership"****, Macmillan India Ltd., New Delhi, 2002.*

2 *NAE Grand Challenges for Engineering (2006),* ***"Engineering for the Developing World"****, The Bridge, Vol 34, No.2, Summer 2004.*

3 *Bogle D. (2010)* ***"UK's engineering Council guidance on sustainability"****. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63*

4 *Brito, Ciampi, Vasconcelos, Amarol, Barros (2013)* ***" Engineering impacting Social, Economical and Working Environment"****, 120th ASEE Annual Conference and Exposition.*

COURSE OUTCOMES:

On Completion of the course, the students will be able to:

CO1: Know the Development of Pre-industrial revolution and Modern Building Materials features & their applications.

CO2: Know the importance, scope and role of different sectors of construction

CO3: Acquire knowledge in environment of sustainability.

CO4: Gain insight knowledge on Built Environment and factors impacting the Quality of Life

CO5: Analyze environment impact in various Civil Engineering projects.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		L			H	M		L	L	L	M		H	L	M
CO2	H		M	L	L	H	M		M	M	L	M	M	H	H	M
CO3	H		M		L	H	H		L	L		L	H	M	M	L
CO4	H	L	L		L	H	H		L	M		M	M	L	M	
CO5	H	M	L	L	M	H	M	L	M	M	H	H	M	M	H	L
18CHS 401	H	M	L	L	L	H	H	L	M	M	H	M	H	H	H	M

L-Low, M-Moderate (Medium), H-High

18CBS402	ENGINEERING GEOLOGY	SEMESTER IV

Category : BS

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* At the end of this course the students will be able to understand the importance of geological knowledge such as earth, earthquake and volcanism.
* To apply geological knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor as well as to choose types of foundation
* To imparts knowledge about the methods used to explore the sub surface for natural resources.
* To know the Engineering significance of the rocks.

UNIT – I : GENERAL GEOLOGY **(9 Periods)**

Interrelationship between Geology and civil engineering – Branches of Geology – Earth Structure and composition –Concept of Plate tectonics, Geological processes, agents and kinds – Weathering, wind,rivers and their Engineering significance - Volcano – Landforms, Materials and Types of Eruptions, Ground water – Properties of rock – Geological work of ground water.

UNIT – II : MINERALOGY **(9 Periods)**

Elementary knowledge on symmetry elements of important Crystallographic systems, Physical properties of minerals – Study of the following rock forming minerals – Quartz family, Felspar family, Biotite , Muscovite, Calcite, Magnesite, Ore minerals - Hematite, Magnetite, Bauxite, Graphite – Clay minerals – Properties and Engineering significance.

UNIT – III : PETROLOGY **(9 Periods)**

Igneous rocks- Occurrence ,Formation ,Texture and Structure, Classification and Engineering properties of Granite, Pegmatite, Dolerite and Basalt. Sedimentary rocks- Process, classification, formation and Engineering properties of Sandstone, Limestone and Shale – Metamorphic rocks – Agents, types, kinds and Engineering properties- Quartzite, Marble, Slate, Gneiss and schist.

UNIT – IV : STRUCTURAL GEOLOGY & ELEMENTS OF SEISMOLOGY **(9 Periods)**

Attitude of beds Dip and Strike - Uses of Clinometer compass – Outcrops – Geological maps – their uses – Structural features – Folds, Faults and Joints – their engineering significance. - Earthquakes – Causes and effects, Seismic waves and seismographs, Elastic rebound theory, Mercelli's scale of intensity, Magnitude - Richter's scale and Earthquake Zones in India -Engineering Considerations.

UNIT – V : GEOLOGICAL INVESTIGATIONS **(9 Periods)**

Geological investigations pertaining to the constructions of Dam and Reservoir, Tunnels and Road cuttings, Rock Quality Designation (RQD)- Aggregate- Ballast, Road metal. Landslides – causes and prevention – Sea erosion and coastal protection. Geophysical investigations - Seismic and electrical resistivity methods and data interpretation.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 Periods

TEXT BOOKS:

1 *Parbin Singh, **"Engineering and General Geology"**, Katson Publication House, 2015.*
2 *Bangar.K.M, **"Principles of Engineering Geology"**, Standard Publishers& Distributors, 1705-B,Naisarak, Delhi,2010.*
3 *S.M.Mathur, **"Elements of Geology"**, PHI learning private limited New Delhi 2010.*
4 *S.Ramamrutham and R.Narayanan, **"Engineering Geology"**, Dhanpat Rai Publishing House, Delhi, 2014.*

REFERENCE BOOKS:

1 *Kesavulu ,**"Text book of Engineering Geology"**, Macmillan Publishers India Ltd, 2009.*
2 *P.C.Varghese , **"Engineering Geology for Civil Engineers"**, PHI Private Ltd., New Delhi, 2012.*
3 *A.B.Roy , **"Fundamentals of Geology"**, Narosa Publication,2010.*

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Know the geological formations of the Earth
CO2: Identify the properties and uses of minerals.
CO3: Gain knowledge on the Engineering properties of rocks.
CO4: Apply fundamental knowledge in structural geology like fault, fold and Joints.
CO5: Know the importance of the study of geology for Civil Engineers with regard to founding Structures like dams, bridges, buildings, etc.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H									H		M	H	L		
CO2	H					L							M		M	
CO3	H	L							M		M		M	M		
CO4	H			M		H		L			H	M	M	H		M
CO5	H		L		M		H			H	M	H				H
18CBS 402	H	L	L	M	M		H	L	M	H	M				M	

L-Low, M- Moderate (Medium), H- High

18CES403	CONSTRUCTION MATERIALS AND TECHNOLOGY	SEMESTER IV

Category : ES

L	T	P	C
4	0	0	4

PRE-REQUISITES:

1 18CBS101 Engineering Chemistry
2 18CBS203 Mechanics and Properties of Solids

COURSE OBJECTIVES:

* To learn the applications and testing procedures of materials used for construction.
* To study the construction practices of different types of structural elements.
* To know the various types of doors, windows, plastering and paintings.

UNIT – I : SUB STRUCTURE CONSTRUCTION (12 Periods)

Functions of foundation – Types of shallow and deep foundations – Caissons and cofferdam – Causes for failures of foundations and remedial measures – Setting out of foundation – Excavation and timbering – Dewatering techniques – Box jacking and Pipe jacking techniques.

UNIT – II : MASONRY AND PLASTERING (12 Periods)

Stones – Types – Characteristics–Stone masonry – Classification – Supervision of stone masonry –
Bricks – Composition – types – BIS tests– Brick masonry – Classification – Supervision of brick masonry – Defects in brick masonry.
Hollow blocks–Composite masonry – Types of wall – Arches and Lintels.
Plastering –Materials and Methods of plastering – Types of plastering – Tools for plastering – Preparation and uses of cement mortar–Defects in plastering – pointing.

UNIT – III : FLOORING AND ROOFING (12 Periods)

Cement –Sand – River sand, M sand and Eco sand – Coarse aggregate –Concrete – **Floors** – Requirements of good floor – Floor finishing materials – Classifications– Terrazzo flooring – Marble flooring – Cement concrete flooring – Tiled flooring – Suitability of floors for various applications.
Damp Proof Course – Causes and effect of dampness –Materials and Methods of damp proofing – Anti-termite treatment.
Roofs– Roofing materials – Requirements –Types– Pitched roof –Flat roof – Flat and Ribbed slab.
Stairs – Requirements – Dimensions – Classifications of stairs – Ramps and Escalators.

UNIT – IV : DOORS, WINDOWS AND PAINTING (12 Periods)

Timber–Defects – Causes of decay –Seasoning – Preservation – Laminated wood products – Properties – Types – Fibre board –Particle boards –Hard boards – A.C boards – Aluminium products – UPVC – Glass – Types – Properties – Applications.
Doors and Windows–Types – Fixtures and Fastening – Ventilators.
Painting –Paints and painting –Classification of paints– Painting on new and old surfaces of steel, timber and masonry wall – Defects in painting.

UNIT – V : CONSTRUCTION PRACTICES (12 Periods)

Centering and shuttering– Formwork– Scaffolding–Plumbing Services.
Structural steel and High Tensile Steel Properties – Types – Market forms of steel–Fabrication and erection of steel trusses – Frames– Launching girders.

Contact Periods: Lecture: 60 Tutorial: 00 Practical:00 Total : 60 Periods

TEXT BOOKS:

1 *Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, **"Building construction"**, Laxmi Publications Pvt. Ltd., 2016.*
2 *Bindra.S.P and Arora.S.P, **"Building construction"**, DhanpatRai Publication Pvt. Ltd., 2010.*

REFERENCE BOOKS:

1 *Edward Allen, Joseph Iano, **"Fundamentals of Building Construction: Materials and Methods"**, Wiley Publishers, 2014.*
2 *Maden Mehta, **"Building Construction"**, Pearson Education Publishers, 2016.*
3 *Varghese P.C, **"Building Construction"**, Prentice Hall of India, 2012.*
4 *Rangwala, **"Building construction"**, Charotar Publishing House Pvt. Ltd., 2016.*

COURSE OUTCOMES:
On Completion of the course, the students will able to

CO1: Select the appropriate type of foundations for building construction.
CO2: Acquire knowledge on different masonry and plastering works.
CO3: Select the suitable type of floors, roofs, stairs and dampness preventing methods for practical applications.
CO4: Apply knowledge for selection of doors, windows paints and materials for buildings.
CO5: Know the different construction practices existing in construction field.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		L			L				L	M			L	M	L
CO2	H						L		H		M		L	L		L
CO3	H	L							M		L	L	H	L	M	L
CO4	H	M	L				L		H		L		M	L	M	L
CO5	H	M	L		M	M			H		M	L	H	M	M	L
18CES 403	H	L	L			L	L		H	L	L	L	H	L	M	L

L-Low, M-Moderate (Medium), H-High

18CPC404	BASIC STRUCTURAL DESIGN I (STEEL)	SEMESTER IV

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES302 Engineering Mechanics for Civil Engineers
2 18CPC303 Strength of Materials

COURSE OBJECTIVES:

* To design the tension and compression steel elements and their connections.
* To Know the behaviour and design of flexural members.
* To know and design the components of industrial buildings.

UNIT -I : SIMPLE STEEL CONNECTIONS (9 Periods)

Steel standard sections – properties – Introduction to Limit State Design.
Bolted connections
Types of bolts – permissible stresses for black bolt, HSFG bolts– Design of a bolt in single shear, double shear and bearing.
Welded connections
Principle of welding – weld symbols – types of welded joints – strength of fillet and butt weld – design of welded connections for lap and butt joint – detailing of weld.

UNIT -II : ECCENTRIC CONNECTIONS AND TENSION MEMBER (9 Periods)

Eccentric Connections: Bracket Connection Type I and Type II.
Tension Members: design of simple and built up members subjected to tension – effective area of angle and Tee sections connected to Gussets –Tension splice – lug angle.

UNIT -III : COMPRESSION MEMBERS (9 Periods)

Axially loaded columns – effective length of compression members –slenderness ratio –strength of compression members – design of columns – built up columns – design of lattices and battens – design of slab base – Gusseted base.

UNIT -IV : BEAMS (9 Periods)

Introduction to plastic analysis - Beams - permissible bending stress - section classification– Design of laterally supported and unsupported simply supported beams – Design of built up beams – curtailment of flange plate – connection between flange plate and beam – need for lateral support of compression flange and design – strength of beams in shear.

UNIT -V : ROOF TRUSSES AND INDUSTRIAL BUILDINGS (9 Periods)

Design of industrial building - roofing, cladding and wall material - structural components and framing - types of roof trusses - components - wind load estimation as per IS875 part 3 - design of purlins and wall girts using Channel and Angle sections - truss members - joints.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1. *Duggal.S.K,* ***"Limit State Design of Steel Structures"****, McGraw Hill Education India (P) Ltd , New Delhi, 2014.*
2. *Subramanian.N,* ***"Design of Steel Structures"****, Oxford University Press, New Delhi, 2016.*
3. *Kanthimathinathan S,* ***"Limit State Design of Steel Structures as per IS 800:2007"****, I.K. Internationl Publishing House Pvt Ltd, New Delhi, 2014*
4. *https://nptel.ac.in/courses/105102088/28*
5. *http://www.nptelvideos.in/2012/11/design-of-steel-structures.html*

REFERENCE BOOKS:

1. *IS: 800 – 2007,* ***"General Construction in Steel"*** *— Code of Practice.*
2. *SP 6(I) – 1964,* ***"Handbook for Structural Engineers"****.*
3. *IS 875- 2015,****" Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Part 3 : Wind Loads".***
4. *Gambhir M.L.* ***"Fundamentals of Structural Steel Design"****, McGraw Hill Publications Pvt. Ltd, 2013.*
5. *Ramachandra,* ***"Design of Steel Structures", Vol. I & II****, Standard publishers Distributors, New Delhi, 2010*
6. *B.C.Punmia, Ashok Kumar Jain and Arun kumar Jain,* ***"Design of Steel Structures, Vol. I & II"****, Laxmi Publications (P) Ltd, 2014.*
7. *Institute For Steel Development & Growth (INSDAG) - Teaching Material*

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Identify the different failure modes of bolted and welded connections and design connections subjected to axial load.
CO2: Analyse and design the eccentric connections and tension members.
CO3: Design compression members and bases.
CO4: Design laterally supported and unsupported beams.
CO5: Design the structural components of industrial buildings.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	L	M	L	L	--	H	--	--	L	M	--	--	--	M	M	--
CO2	M	M	L	L	--	M	--	--	--	L	--	--	--	M	M	--
CO3	M	M	L	L	--	M	--	--	--	L	--	--	--	M	M	--
CO4	M	M	L	L	--	M	--	--	--	L	--	--	--	M	M	--
CO5	M	M	L	L	L	H	--	--	L	M	--	--	--	M	M	--
18CPC 404	M	M	L	L	L	H	--	--	M	M	--	--	--	M	M	--

L-Low, M-Moderate (Medium), H-High

18CPC405	APPLIED HYDRAULICS AND FLUID MACHINERY	SEMESTER IV

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC304 - Mechanics of Fluids

COURSE OBJECTIVES:

* To know open channel hydraulics with the knowledge of uniform and non- uniform flows.
* To apply the dimensional analysis for solving problems.
* To apply the impulse momentum principle for the performance study of hydraulic machines.
* To know the operating principle of positive displacement pumps.

UNIT – I : OPEN CHANNEL FLOW (9 Periods)

Uniform flow – Velocity measurement – Manning's and Chezy's formula – Roughness coefficients – Normal depth and velocity – Most economical sections –Wide open channel – Specific energy – Critical flow and its computation - Dynamic equations of gradually varied flow – Assumptions – Characteristics of flow profiles – Draw down and back water curves – Hydraulic jump – Types – Energy dissipation.

UNIT – II : DIMENSIONAL ANALYSIS (9 Periods)

Dimensional Homogeneity-Rayleigh's and Buckingham methods- Model study and similitude – scale effects and distorted model.

UNIT – III : MOMENTUM PRINCIPLE (9 Periods)

Impulse momentum Principle - impact of Jet – force exerted by a jet on normal, inclined and curved surfaces for stationary and moving vanes - Angular momentum principle - Inlet and outlet flow diagrams.

UNIT – IV : TURBINES (9 Periods)

Turbines - Classification - Impulse and Reaction Turbines - radial flow turbines - axial flow turbines - - work done and efficiency - draft tube and cavitation - Governing and Selection of Turbines - operating characteristic curves of turbines - Specific speed - Run away Speed.

UNIT – V : PUMPS (9 Periods)

Introduction to Modern pumping machinery - Centrifugal pump - Work done and Efficiency - minimum speed to start the pump - NPSH (Net positive Suction Head) - Cavitation in Pumps - multistage Pumps - Jet and submersible pumps - Positive displacement pumps - Reciprocating pump - Work done and Efficiency - negative slip - flow separation conditions - air vessels - indicator diagram and its variation - savings in work done - Rotary Pumps: Gear Pumps.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total:45 Periods

TEXT BOOKS:

1 *P.N.Modi and S.N.Seth, **"Hydraulics and Fluid Mechanics, Including Hydraulic Machines"**, Standard Book House, New Delhi, 2015.*
2 *D.S.Kumar, **"Fluid Mechanics and Fluid Power Engineering"**, S.K.Kataria& Sons, New Delhi, 2012.*
3 *R.K.Bansal, **"Fluid Mechanics and Hydraulic Machines"**, Laxmi Publications (P) Ltd., New Delhi, 2018.*

REFERENCE BOOKS:

1 *Natarajan M.K, **"Principles of Fluid Mechanics"**, Anuradha Agencies, VidayalKaruppur, Kumbakonam,2008.*
2 *Subramanya K., **"Flow in Open channels"**,Tata McGraw-Hill Publishing Company, 2015.*
3 *S.Ramamurtham and R.Narayanan, **"Hydraulics Fluid Mechanics and Fluid Machines"** Dhanpat Rai Publishing Company (P) Limited, 2014.*
4 *R.K.Rajput, **"A Text Book of Fluid Mechanics and Hydraulic Machines"**, S.Chand and Company, New Delhi, 2015.*
5 *D.Ramadurgaiah, **"Fluid Mechanics and Machinery"**, New age International (P) Ltd., 2007.*

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Gain insight knowledge on Open channel hydraulics and to solve practical problems.
CO2: Apply the concepts of dimensional analysis for fluid flow problems.
CO3: Apply the impulse momentum principle for the determination of hydrodynamic forces.
CO4: Analyze the performance of turbines and design of turbines..
CO5: Analyze the performance of pumps and design of pumps.

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COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	--	M	M	M	M	H	L	L	--	M	L	H	H	H
CO2	H	H	--	M	M	M	M	H	L	L	L	M	L	H	H	H
CO3	H	H	M	M	--	--	H	M	L	L	--	M	L	H	M	H
CO4	H	H	--	H	M	M	M	M	L	L	L	M	L	H	H	M
CO5	H	H	--	M	--	--	H	M	L	L	L	M	L	H	M	H
18CPC 405	H	H	M	M	M	M	M	M	L	L	L	M	L	H	H	H

L-Low, M-Moderate (Medium), H-High

18CPC406	WASTEWATER ENGINEERING	SEMESTER IV

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC306 - Water Supply Engineering

COURSE OBJECTIVES:

* To learn the basics of sewage composition and its characteristics.
* To give information about Sewer and its design.
* To depict the information about various sewage treatment processes
* To provide the adequate information on various disposal methods

UNIT – I : QUANTITY AND HOUSE DRAINAGE (9 Periods)

Necessity and objectives of sanitary engineering projects - Definitions - systems of sewerage - quantity of sewage - Fluctuations in flow pattern - Estimation of storm runoff - DWF and WWF - Design flow for separate and combined systems - House drainage - Sanitary fixtures / fittings - one pipe system, two pipe system - General layout of house drainage - street connections

UNIT – II : SEWER AND SEWER APPURTENANCES (9 Periods)

Hydraulics of sewers - Self cleansing velocities - full flow / partial flow conditions - sewer sections – sewer appurtenances - Design principles and procedures - materials for sewers - sewer joints - sewer laying –sewer cleaning and maintenance - sewage pumping - types of pumps.

UNIT – III : QUALITY OF SEWAGE AND PRIMARY TREATMENT (9 Periods)

Characteristics and composition of sewage - physical and chemical analysis - DO, BOD,COD and their Significance - cycles of decomposition - Objectives and basic principles of sewage treatment - primary treatment- screens - Grit chamber - settling tank - principles of sedimentations - Design of settling tanks.

UNIT – IV : BIOLOGICAL TREATMENT OF SEWAGE (9 Periods)

Basic principles of biological treatment - Filtration - contact beds - Sand Filters - trickling filters - Description and principles of operation of standards / high rate filters - recirculation - activated sludge process - diffuser /Mechanical aeration - Conventional, high rate and extended aeration process - oxidation pond - stabilization ponds - aerated lagoons - Septic tanks and effluent disposal system.

UNIT – V :SEWAGE DISPOSAL AND SLUDGE MANAGEMENT (9 Periods)

Objectives of sludge treatment - properties and characteristics of sludge - Thickening - sludge digestion - drying beds - conditioning and dewatering - sludge disposal - Eutrophication - recycle & reuse of waste effluents - elutriation - Methods - dilution method – self-purification of streams - oxygen sag curve - land disposal – sewage farming.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Garg S.K., **"Sewage Disposal and Air Pollution Engineering"**, Khanna Publishers, New Delhi, 2018*
2 *Hussain. S. K., **"Text Book of Water Supply and Sanitary Engineering"**, Oxford and IBH Publishing.2017*
3 *S. C. Rangwala and K. S. Rangwala, **"Water Supply and Sanitary Engineering"**, Charotar Publishing house 2016*
4 *Punmia B.C, Jain A.K and Jain A.K, **"Environmental Engineering Vol-II"** Laxmi Publications, 2016*
5 *Mark J. Hammer, Mark J. Hammer Jr, **"Water and Waste Water Technology"**, Prentice hall of India 2011*

REFERENCE BOOKS:

1 *Mackenzie L Davis.,**"Water and Waste Water Engineering Design Principles and Practice"**, McGraw Hill book education,2010.*
2 *Fair. G. M..,Geyer. J. C., **"Water Supply and Waste Water disposal"**, John Wiley & Sons,2010*
3 *Babbit. H. E., and Donald. J. J., **"Water Supply Engineering"**, McGraw Hill book Co, 2011*
4 *Duggal. K.N., **"Elements of public Health Engineering"**, S.Chand and Co, 2007. Jain Publishers, CPHEECO MANUAL*
5 *Metcalf and Eddy **"Waste Water Engineering- Treatment and Reuse"** Tata Mc-Graw Hill Company, New Delhi 2007*
6 *NPTEL **"Water and Waste Water Engineering"** by Dr.P.Bose, IIT Kanpur*

COURSE OUTCOMES:

On Completion of the course, the students will able to

CO1: Attain knowledge on sewage production and house drainage.
CO2: Design of sewerage system
CO3: Analyse the quality of sewage and design of primary treatments of sewage.
CO4: Understand and design the biological treatments of sewage.
CO5: Apply suitable sludge treatment and disposal method.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L					H					L	L	L	L	M
CO2	H	M	M	L			H	L				L		M	L	M
CO3	H	M	L	L			H	L				L	M	M	L	M
CO4	H	M	L			L	H					L	M	M	H	M
CO5	H	L				L	H	L				L		L	L	M
18CPC 406	H	M	L	L		L	H	L				L	M	M	L	M

L-Low, M-Moderate (Medium), H-High

18CMC4Z7	ENVIRONMENTAL SCIENCES AND ENGINEERING *(Common to all Branches)*	SEMESTER IV

Category : MC

L	T	P	C
3	0	0	0

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart knowledge on environmental resources, ecosystem and biodiversity.
- To learn about sources, effects and control of the environmental pollution.
- To create an awareness on social issues on environment.

UNIT I: ENVIRONMENTAL RESOURCES **(9 Periods)**

Natural resources-Forest – benefits, over exploitation, deforestation & consequences – Water- unique features, hydrological cycle & over exploitation – Food -effect of modern agriculture, fertilizers, pesticides, eutrophication & biomagnifications- Energy resources - renewable & non-renewable resources - wind, solar and tidal-harnessing methods.

UNIT II: ECO SYSTEM AND BIODIVERSITY **(9 Periods)**

Ecology - ecosystem, physical and chemical components of ecosystem, biological components of ecosystem, forest ecosystem, desert ecosystem and pond ecosystem, Energy flow in ecosystem, nitrogen cycle and carbon dioxide cycle, food pyramid, Ecological succession, Biodiversity - types, values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity – in situ – ex situ conservation.

UNIT III: ENVIRONMENTAL POLLUTION **(9 Periods)**

Air pollution, classification of air pollutants – sources, effects and control of gaseous pollutants SO_2, NO_2, H_2S, CO, CO_2 and particulates, control methods - cyclone separator and electrostatic precipitator, water pollution - classification of water pollutants, organic and inorganic pollutants, sources, effects and control of water pollutants, soil pollution- sources, effects and control, noise pollution - decibel scale , sources, effects and control.

UNIT IV: ENVIRONMENTAL THREATS **(9 Periods)**

Acid rain, greenhouse effect, global warming and ozone depletion, disaster management - flood, drought, earthquake and tsunami, Threats to biodiversity-destruction of habitat, habit fragmentation-hunting, over exploitation and man-wildlife conflicts, The IUCN red list categories, status of threatened species.

UNIT V: SOCIAL ISSUES AND ENVIRONMENT **(9 Periods)**

Sustainable development- sustainable technologies, need for energy and water conservation, rain water harvesting, water shed management, waste land reclamation, Pollution control Act, Wild life protection act, Forest conservation act, population growth- exponential and logistic growth, variation in population among nations, population policy, women and child welfare programs, role of information technology in human and health, HIV/AIDS - effects and preventive measures.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 periods

TEXT BOOKS:

1. *Sharma J.P., **"Environmental Studies"**, 3rd Edition, University Science Press, New Delhi 2009.*
2. *Anubha Kaushik and C.P.Kaushik, **"Environmental Science and Engineering"**, 3rd Edition, New age International Publishers, New Delhi, 2008.*

REFERENCE BOOKS:

1. *R.K.Trivedi, **"Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards"**, Vol.I&II, Environ Media, 2006.*
2. *G.TylerMiller, JR, **"Environmental Science"**, Tenth Edition, Thomson BROOKS / COLE Publishing, 2004.*
3. *Gilbert M.Masters, **"Introduction to Environmental Engineering and Science"**, 2nd Edition, Pearson Education, 2004.*

COURSE OUTCOMES:

Upon the completion of the course, Students will be able to

CO1: Identify the various environmental resources, the effective utility and solve problems accompanied in over exploitation.

CO2: Assess the interaction of biosphere with environment and propose conservation methods of bio diversity

CO3: Predict the sources of various types of pollution, their ill effects and demonstrate preventive methods.

CO4: Outline the effects of the environmental threats, Acid rain, Green house effect and ozone depletion and natural disasters.

CO5: Propose solutions for sustainable development and social issues.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	L	H	L	M	M	M	M	M	M		L	L	L	M
CO2	H	L	L	L		L	L			L		L	M	L	L
CO3	H	L	H	L		L	M			M		L	L	L	L
CO4	H	L	H	L	L	L	L			L		L	L	L	L
CO5	H	L	H	L	L	L	H	H	L	M		L	M	L	M
18CMC 4Z7	H	L	H	L	L	L	H	M	L	M		L	M	L	L

L - Low, M - Moderate (Medium), H – High

18CPC408	FLUID MECHANICS AND MACHINERY LABORATORY	SEMESTER IV

Category : PC

L	T	P	C
0	0	3	1.5

PRE-REQUISITES:

1 18CPC304 Mechanics of Fluids

COURSE OBJECTIVES:

* To impart knowledge in solving problems occurring in a pipes due to major and minor losses.
* To know the concept of Bernoulli's theorem and their applications.
* To conduct performance tests on different types of pumps and turbines.

LIST OF EXPERIMENTS:

1. Determination of Major and Minor losses in pipes
2. Verification of Bernoulli's Theorem
3. Calibration of Venturimeter and Orificemeter
4. Flow over Rectangular and V- Notches
5. Flow through Mouthpiece / Orifice
6. Determination of velocity through Pitot tube
7. Calibration of pressure gauges
8. Determination of Meta centric height
9. Performance Study of Rotodynamic pumps: Centrifugal pump, Submersible pump , Vertical Turbine Pump and Jet pump
10. Performance Study of Positive displacement pumps: Reciprocating pump, Gear oil pump and Single screw pump.
11. Load test on Pelton wheel, Francis turbine and Kaplan Turbines.

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 45 Total:45 Periods

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Obtain the knowledge on conducting different experiments.
CO2: Solve different problems in pipes due to major and minor losses.
CO3: Verify the Bernoulli's theorem and its applications.
CO4: Do performance tests on different types of pumps.
CO5: Do performance tests on different types of turbines.

COURSE ARTICULATION MATRIX:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	H	M	L	M	--	M	--	L	--	L	--	H	M	L
CO2	H	H	M	H	--	L	L	--	--	M	--	L	--	M	H	M
CO3	H	M	--	H	--	--	L	--	--	L	--	--	--	H	H	L
CO4	H	H	M	--	--	L	--	L	L	M	--	--	--	M	H	L
CO5	H	M	--	H	--	--	L	--	--	L	--	--	--	H	M	L
18CPC408	H	H	H	H	L	M	L	M	L	M	--	L	--	H	H	M

L-Low, M-Moderate (Medium), H-High

18CPC409	ENVIRONMENTAL ENGINEERING LABORATORY	SEMESTER IV

Category : PC

L	T	P	C
0	0	3	1.5

PRE-REQUISITES:

1. 18CPC306 Water supply engineering

COURSE OBJECTIVES:

* To know the sampling procedures of water and waste water samples.
* To have knowledge on preservation methods of samples.
* To conduct laboratory tests on characterization of water/wastewater samples.

LIST OF EXPERIMENTS

1. Sampling and preservation methods for water and wastewater (Demonstration only).
2. Determination of pH & Electrical Conductivity.
3. Determination of Turbidity.
4. Determination of Chlorides.
5. Determination of Total Hardness.
6. Determination of Calcium Hardness.
7. Determination of Alkalinity.
8. Determination of Acidity.
9. Determination of Sulphates.
10. Determination of Iron & Fluoride.
11. Estimation of Residual Chlorine.
12. Estimation of Solids.
    a) Determination of Total Suspended solids.
    b) Determination of Dissolved solids.
    c) Determination of Fixed and Volatile solids.
    d) Determination of Total solids.
13. Determination of Optimum Coagulant Dosage.
14. Determination of Dissolved Oxygen.
15. Determination of BOD.
16. Determination of COD.
17. Standard Plate Count Test.

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 45 Total:45 Periods

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Know sampling and preservation methods of water and wastewater
CO2: Determine the physical properties of water and waste water.
CO3: Determine the chemical properties of water and waste water.
CO4: Determine the biological properties of water and waste water.
CO5: Determine the Micro-biological properties of water and waste water.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L	L	M	--	--	--	--	--	--	--	L	M	H	L	L
CO2	M	L	L	M	--	M	--	--	--	--	--	L	M	H	L	L
CO3	M	L	L	M	--	M	--	--	--	--	--	L	M	H	L	L
CO4	M	L	L	M	--	M	--	--	--	--	--	L	M	H	L	L
CO5	M	L	L	M	--	M	--	--	--	--	--	L	M	H	L	L
18CPC409	M	L	L	M	--	M	--	--	--	--	--	L	M	H	L	L

L-Low, M-Moderate (Medium), H-High

18CHS501	PROFESSIONAL PRACTICES, ETHICS AND BUILDING BYE- LAWS	SEMESTER V

Category : HS

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To create an awareness on Human Values and Engineering Ethics.
* To know the contracts management and various legal aspects related to Civil Engineering.
* To familiarize the students with elementary knowledge of Building bye-laws.

UNIT – I : HUMAN VALUES AND PROFESSIONAL ETHICS (9 Periods)

Introduction human values – Morals – Civic virtue – Ethics – Work ethics – Engineering Ethics – Professional Ethics – Business Ethics – Corporate Ethics – Engineering Ethics – Personal Ethics – Code of Ethics by Institution of Engineers (India) – Uses of Ethical Theories – Profession and Professionalism – Professional Responsibility – Conflict of Interest – Gift Vs Bribery – Environmental breaches – Negligence – Deficiencies in state of the art – Vigil Mechanism – Whistle blowing – Protected disclosures.

UNIT – II : PROFESSIONAL PRACTICES (9 Periods)

Respective roles of various stakeholders: **Government** (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens) – **Standardization Bodies** (BIS, IRC)(formulating standards of practice) –**Professional bodies** (Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction) –**Clients/ owners** (role governed by contracts) –**Developers** (role governed by regulations such as RERA) –**Consultants** (role governed by bodies such as CEAI) –**Contractors** (role governed by contracts and regulatory Acts and Standards) –**Manufacturers/ Vendors/ Service agencies** (role governed by contracts and regulatory Acts and Standards).

UNIT – III : CONTRACT, LABOUR AND CONSTRUCTION LAW (9 Periods)

Indian Contract Act (1972) and amendments covering General principles of contracting–Contract Formation and Law – Privacy of contract– Industrial Disputes Act (1947) – Industrial Employment (Standing Orders) Act (1946) –Workmen's Compensation Act (1923) – Building and Other Construction Workers (Regulation of employment and conditions of service) Act (1996) and Rules (1998) – RERA Act (2017) – National Building Code (2017).

UNIT – IV : ARBITRATION AND INTELLECTUAL PROPERTY RIGHTS (9 Periods)

Arbitration – Matters for reference to arbitration – Kinds of Arbitration– Arbitrator – Appointment, powers, disabilities – Arbitration agreements– Process – Arbitration Award – Dispute Resolution Methods.

Intellectual Property Rights (IPR): Introduction – Forms of IP– Law relating to Copyright in India– Patentable inventions – Process of obtaining patent – Law and policy relating to Patents – Infringement and related remedies.

UNIT – V : BUILDING BYE-LAWS (9 Periods)

General – Objective – Importance – Applicability – Principles – Standard guidelines of building elements – Provision for access, Lighting and Ventilation, Fire protection, Drainage and sanitation – Requirement for parking, Landscaping, Low income housing –Building bye-laws for various types of buildings.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 Periods

TEXT BOOKS:

1 *Govindarajan M,Natarajan S, Senthil Kumar V. S, **"Engineering Ethics"**, Prentice Hall of India, New Delhi, 2004.*
2 *Dr.Kumaraswamy, A.K.Kameswara Rao, **"Building Planning and Drawing"**, Charotar Publishing Housing Pvt. Ltd., 2015.*

REFERENCE BOOKS:

1 *Mike W. Martin and Roland Schinzinger, **"Ethics in Engineering"**, Tata McGraw Hill, New Delhi, 2003.*
2 *Neelima Chandiramani, **"The Law of Contract: An Outline"**, Avinash Publications Mumbai, 2000.*
3 *T. Ramappa, **"Intellectual Property Rights Law in India"**, Asia Law House, 2010.*
4 *National Building Code – 2017.*

COURSE OUTCOMES:

On completion of the course, the students will able to
CO1: Apply the knowledge of Human Values and Professional ethics.
CO2: Familiarize in professional practices and roles of various stakeholders.
CO3: Implement the Contract, Labour and Construction Laws in Civil Engineering profession.
CO4: Apply knowledge on Arbitration and Intellectual Property Rights.
CO5: Develop good insight into Building by-laws.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	--	L	--	--	M	--	H	--	--	L	L	--	--	L	L
CO2	--	--	L	--	--	M	L	H	L	--	M	L	--	--	M	L
CO3	H	--	L	--	--	H	--	H	L	--	M	L	L	M	H	L
CO4	H	L	H	L	L	M	--	L	L	L	M	L	--	L	M	L
CO5	M	L	M	L	--	H	M	--	L	--	M	M	M	L	M	L
18CHS 501	H	L	M	L	L	M	M	H	L	L	M	L	L	M	H	L

L-Low, M-Moderate (Medium), H-High

18CPC502	STRUCTURAL ANALYSIS I	SEMESTER V

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES302 Engineering Mechanics for Civil Engineers
2 18CPC303 Strength of Materials

COURSE OBJECTIVES:

* To impart knowledge on basic concepts to analyze different kind of structures.
* To learn the influence line concept for beam, arches.
* To understand the concepts of analysis of cables and suspension bridges.

UNIT – I : STATICALLY INDETERMINATE BEAMS (9 Periods)

Propped Cantilever Beams – Fixed Beams – Continuous Beams – Theorem of Three Moments – Calculation of reactions, Bending Moments and Shear Force – Shear Force and Bending Moment Diagrams (for all Types of Loadings, Couple).

UNIT – II : ENERGY METHODS (9 Periods)

Static and Kinematic Indeterminacy – Beams, Trusses and Frames –Equilibrium and Kinematic Stability — Energy principles – Strain energy and Complementary Energy – Principle of Virtual Work – Castigliano's First and Second Theorem –Theorem of least work – Clark Maxwell's reciprocal theorem – Application to simple problems of statically determinate beams, trusses and frames.

UNIT – III : ROLLING LOADS AND INFLUENCE LINES ON BEAMS (9 Periods)

Determinate Beams: Rolling loads - Single concentrated load– UDL longer than the span – UDL shorter than the span– Two concentrated loads – Series of concentrated loads – Equivalent UDL.
Influence lines - reactions, shear force, bending moment, absolute maximum shear force and absolute maximum bending moment for all types of loads.
Indeterminate beams: Muller Breslau's principle - influence lines for continuous beams.

UNIT – IV : ARCHES (9 Periods)

Three hinged arch – Two hinged arch – symmetrical and unsymmetrical - parabolic and circular arches under concentrated loads and uniformly distributed - Temperature effects – Rib shortening.
Influence lines -Symmetrical parabolic arch – single rolling load and uniformly distributed load – Unsymmetrical arches - Influence lines for horizontal thrust.

UNIT – V : CABLES AND SUSPENSION BRIDGES (9 Periods)

Suspension bridges - Components and their Functions - Analysis of cable - Three hinged and Two hinged stiffening girders –Influence lines for Shear Force and Bending Moment.

Contact Periods: Lecture: 45 Tutorial: 00 Practical:00 Total : 45 Periods

TEXT BOOKS:

1 *Reddy C.S., **"Basic Structural Analysis"**, Tata McGraw Hill Publishing Co., 2015.*
2 *Punmia B.C, Er.Ashok K Jain, Dr. Arun K Jain, **"Theory of Structures, SMTS.II"**, Laxmi publications, 2017.*
3 *Vaidyanathan.R, Perumal.P., **"Structural Analysis I"**, Laxmi Publications, 2016.*
4 *NPTEL notes - https://nptel.ac.in/courses/105105166*

REFERENCE BOOKS:

1 *Negi L.S and Jangid R.S., **"Structural Analysis"**, Tata McGraw - Hill Publishing Company, New Delhi, 2003.*
2 *Ramamurtham. S, **"Theory of structures"**, Dhanpat Rai & Sons, New Delhi, 2018.*
3 *Thandavamoorthy.T. S., **"Structural Analysis"**, Oxford Publishers, 2011.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Analyse the indeterminate beams using Theorem of three moments.
CO2: Evaluate the redundancy and analyse the determinate structures using energy methods.
CO3: Solve the determinate and indeterminate beams with rolling loads.
CO4: Analyse three and two hinged arches.
CO5: Solve the problems on cables and suspension bridges.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	L	L								M		H	M	L
CO2	H	M	L	L								M		H	M	L
CO3	H	H	L	L								M		H	M	M
CO4	H	M	L	L								M		H	M	M
CO5	H	H	L	L								M		H	M	M
18CPC 502	H	H	L	L								M		H	M	M

L-Low, M-Moderate (Medium), H-High

18CPC503	BASIC STRUCTURAL DESIGN II (CONCRETE)	SEMESTER V

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC303 Strength of Materials
2 18CPC404 Basic Structural Design I (Steel)

COURSE OBJECTIVES:

* To know the design philosophies of concrete structures.
* To understand the limit state design of flexural members and to know the behaviour of RC beams in shear and torsion.
* To acquire knowledge on the concepts of limit state design of columns and footings.

UNIT -I : REINFORCED CONCRETE MATERIALS (9 Periods)

Stress strain curve for concrete – Standard concrete mixes for RCC works – types of Reinforcements – plain and deformed bars – Stress – strain curve for reinforcing steel - Design philosophy – Basic design concepts – working stress, ultimate load and limit state methods - Characteristic load and strength – permissible stresses – partial safety factors – limit state of collapse– limit state of Serviceability – Durability limit state – deflection and cracking – modification factors.

UNIT -II : LIMIT STATE DESIGN OF BEAMS (9 Periods)

Analysis and design of singly and doubly reinforced rectangular and flanged beams - Design of sections subjected to the combined action of bending moment, transverse shear and torsion.

UNIT -III : LIMIT STATE DESIGN OF SLABS (9 Periods)

Behaviour of one way and two way slabs – Analysis, design and detailing of one way and two way rectangular slabs subjected to uniformly distributed load - Design of lintel and lintel cum sunshade – Design of stair case

UNIT -IV : LIMIT STATE DESIGN OF COLUMNS (9 Periods)

Types of columns – Design of rectangular and circular columns for axial load – Design of short columns subjected to axial load and uniaxial / biaxial bending - Interaction charts.

UNIT -V : LIMIT STATE DESIGN OF FOOTINGS (9 Periods)

Design of wall footing – strip foundation to wall under axial load, eccentric load – Design of isolated footing for axially loaded columns.

Contact Periods: Lecture: 45 Tutorial: 00 Practical:00 Total : 45 Periods

TEXT BOOKS:

1. *Pillai, S. U. and Menon, D, **"Reinforced Concrete Design"**, Tata McGraw Hill, 2017*
2. *Shah V.L and Karve S.R, **"Limit State Theory and Design of Reinforced Concrete"**, Structures Publications, 2014.*
3. *Varghese P.C, **"Limit State Design of Reinforced Concrete"**, Prentice hall of India Pvt. Ltd., 2008*
4. *https://nptel.ac.in/courses/105105105*

REFERENCE BOOKS:

1. *IS: 456 – 2000, Indian Standard code of practice for Plain and Reinforced concrete.*
2. *DayaratnamP., **"Design of Reinforced Concrete Structures"**, Oxford & IBH publishing Co. Pvt. Ltd., 2011.*
3. *Subramanian N, **"Design of Reinforced Concrete Structures"**, Oxford University Press, 2014.*
4. *Krishnaraju N, **"Design of Reinforced Concrete Structures"**, CBS Publishers and Distributors Pvt Ltd, 2016.*
5. *Sinha.S.N, **"Reinforced Concrete Design"**, Tata McGraw Hill Education Pvt Ltd., 2014.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Apply the concepts of working stress and limit state methods.
CO2: Design of rectangular beams for flexure, shear and torsion.
CO3: Perform the design and detailing of rectangular slabs and staircases by limit state method.
CO4: Design the columns subjected to both axial and eccentric loads and understand the use of interaction diagrams.
CO5: Design axially and eccentrically loaded wall and isolated footings.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L	L	L	--	M	--	--	--	L	--	--	--	--	--	--
CO2	M	M	L	L	--	M	--	--	L	L	--	--	--	M	M	--
CO3	M	M	L	L	--	M	--	--	L	L	--	--	--	M	M	--
CO4	M	M	L	L	--	M	--	--	L	L	--	--	--	M	M	--
CO5	M	M	L	L	--	M	--	--	L	L	--	--	--	M	M	--
18CPC 503	M	M	L	L	--	M	--	--	L	L	--	--	--	M	M	--

L-Low, M-Moderate (Medium), H-High

18CPC504	MECHANICS OF SOILS	SEMESTER V

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC304 Mechanics of Fluids

COURSE OBJECTIVES:

* To impart knowledge on the basic and Engineering properties of soils.
* To get exposure on stress distribution due to self-weight of soils and due to externally applied loads.
* To assess flow through soil and to familiarize with the flow net diagrams.
* To acquire knowledge on the Engineering behaviour of soils such as compaction, consolidation and shear strength of soils.

UNIT – I : BASIC PROPERTIES OF SOILS (9 Periods)

Soil formation and deposition– Scope of soil Engineering-Basic definitions and relationship-– Physical properties of soil – Phase relations – plasticity characteristics of soils-Consistency limits and Indices–Grain size distribution– Soil classification system –significance – Field identification – Simple tests.

UNIT – II : STRESSES IN SOILS (9 Periods)

Soil water statics – Concept of effective and neutral stresses –effect of water table- Capillary phenomenon – Vertical stress distribution in soils – Boussinesq's equation – Line load – Uniformly distributed loads – Newmark's chart – Construction and use –Approximate methods – Pressure bulb – Westergaard's equation.

UNIT – III : PERMEABILITY AND SEEPAGE (9 Periods)

One dimensional flow through soil – Permeability – Darcy's law – Laboratory and field methods – Factors influencing permeability – Flow through stratified soil – Seepage Analysis-Introduction, stream function and potential function-Seepage pressure – Quick sand condition – Soil liquefaction – Two dimensional flow – Laplace equation – Electrical analogy – Flow net –Methods of construction – Properties – Applications – Sheet pile cut off and earth dam.

UNIT – IV : COMPACTION AND CONSOLIDATION (9 Periods)

Compaction – Laboratory test – Standard proctor's compaction – Modified proctor's compaction – Factors affecting compaction – Field compaction methods – Compaction control. Consolidation – Initial, Primary and Secondary consolidation- Laboratory test – Interpretation of consolidation test results-Determination of C_v by curve fitting methods – Terzaghi's theory of consolidation – Computation of consolidation settlement-Maximum past stress, OCR – Field curve – Pre consolidation pressure – e vs p curve– Time factor – Time rate of consolidation.

UNIT – V : SHEAR STRENGTH (9 Periods)

Mohr circle –Characteristics- Principal Planes and Principal stresses- Mohr-Coulomb's strength criterion – Factors affecting shear strength – Types of shear tests– Direct shear – Triaxial compression – Drainage conditions – UCC – Vane shear – Cyclic loading – Skempton's pore pressure coefficients.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *GopalRajan and Rao, A.S.R.,**"Basic and Applied Soil Mechanics"**, New Age International Publishers, Third Edition, New Delhi, 2006.*
2 *Palanikumar, M.,**"Soil Mechanics"**, PHI Learning Pvt. Ltd., 2013.*
3 *Murthy, V.N.S.,**"Principles of Soil Mechanics and Foundation Engineering"**, Fifth revised edition, UBS Publishers' Distributors Ltd., New Delhi, 2001.*
4 *Braja M.Das, **"Textbook of Geotechnical Engineering"**, Cengage Learning India Private Limited, New Delhi, 2011.*

REFERENCE BOOKS:

1 *Venkataramaiah. C, **"Geotechnical Engineering"** Revised Third Edition, New Age International (P) Ltd. Publishers, New Delhi, 2006.*
2 *Coduto D.P., **"Geotechnical Engineering – Principles and Practices"**, Prentice Hall of India Pvt.Ltd.,New Delhi, 2002.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Identify different types of soil, performs laboratory experiments to assess the physical, engineering properties of soil and to classify the soil.
CO2: Acquire knowledge on the soil water system, plot stress distribution diagrams and compute vertical stress due to various loading conditions.
CO3: Perform the permeability and seepage through soils.
CO4: Evaluate the compaction and consolidation characteristics of soils.
CO5: Determine graphically and analytically the shear stresses in any plane.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M							H		H		H	H	L	
CO2		H		M					M	L	H		M	H	M	
CO3	M	H					H		H	L	H		M	H	H	
CO4		H							H	H	H		M	H	H	
CO5		H	L						H		H		M	H	H	
18CPC 504	H	H		M			H		H	L	H		M	H	H	

L-Low, M-Moderate (Medium), H-High

18CPC507	GEOTECHNICAL ENGINEERING LABORAORY	SEMESTER V

Category : PC

L	T	P	C
0	0	3	1.5

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart practical knowledge on testing of soil for various physical properties.
- To evaluate the engineering properties of the soil.
- To determine the swell-shrink behaviour of soils.

LIST OF EXPERIMENTS

1. Moisture content determination.
2. Specific gravity and relative density test for sand.
3. Sieve analysis for coarse grained soil.
4. Hydrometer analysis for fine grained soil.
5. Consistency limits.
6. Field density tests (Sand replacement method and core cutter method).
7. Permeability tests (Constant Head method and variable Head method).
8. Direct Shear test.
9. Unconfined compression test for Soil.
10. Vane Shear Test for Cohesive Soil.
11. Standard Proctor's Compaction Test.
12. Consolidation Test.
13. Differential free swell tests.
14. Swell Pressure Test.
15. Triaxial Compression Test (Demonstration only).
16. Standard Penetration Test (Demonstration only).
17. SCPT and DCPT (Demonstration only).

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 45 Total:45 Periods

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Characterize the soils and classify soil based on physical properties **.**

CO2: Evaluate the engineering properties of soil and classify soil based on the engineering properties of soil.

CO3: Perform tests on swell characteristics of soils.

CO4: Judge the suitability of soil for different types of foundations.

CO5: Implement the knowledge on handling of field testing equipments

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H	M			L	L	M	M	H		H	H	M	
CO2	H	M	H	H			L	L		M	H			H	M	
CO3	M		H	M						H				H		
CO4	H		H					H	M	H	H	L		H	H	
CO5	H		H	H		H	H	H	H		H	H		H	H	H
18CPC507	H	M	H	H		H	L	L	M	H	H	L	H	H	M	H

L-Low, M-Moderate (Medium), H- High

18CEE508	COMPUTER AIDED CIVIL ENGINEERING DRAWING	SEMESTER V

Category : EEC

L	T	P	C
0	0	3	1.5

PRE-REQUISITES:

1 18CES106 – Engineering Graphics
2 18CES403 – Construction Materials and Technology

COURSE OBJECTIVES:

* To get exposure planning and preparation of building drawings as per Indian and International standards.
* To familiarize National Building code and bye-laws for planning any building.
* To learn drafting of detailed drawing of structural elements of any building in AutoCAD software with the regulations of Indian standards.

INTRODUCTION TO BUILDING DRAWING

Types of Buildings - Building Regulations as per Indian Standards – Drawing Tools - Standard Paper Size - BIS, ISO Specifications and Notations.

BUILDING PLANNING

Provisions of National Building Code - Building bye-laws - open area – setbacks- FAR terminology - Principles of planning - orientation - ventilation and lighting. Provisions for differently abled persons.

PLANNING OF RESIDENTIAL AND HOSPITAL BUILDINGS - INSTITUTIONAL, COMMERCIAL AND INDUSTRIAL BUILDINGS

An introduction to Building Information Modeling - Project phases - Collaboration in construction

LABORATORY EXERCISES

PREPARATION OF LINE SKETCHES AS PER NATIONAL BUILDING CODE AND DETAILED DRAWINGS BY MANUAL AND BY USING AUTOCAD

1. Residential buildings
2. Educational buildings
3. Institutional buildings
4. Assembly buildings
5.Industrial buildings

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 45 Total :45 Periods

TEXT BOOKS:

1 *Kumara Swamy N. and Kameswara Rao A., **"Building Planning And Drawing"**, Charotar Publishing House Pvt. Ltd., 2013*
2 *Mark W. Huth Delmar, **"Understanding Construction Drawings"**, Cengage Publishers, 2013.*
3 *Shah, M.G, Kale, C.M, Patki, S.Y, **"Building Drawing - With an Integrated Approach to Built Environment"**, Tata McGraw-Hill, 2007.*

REFERENCE BOOKS:

1 *Randy Shih, **"Autocad 2016 Tutorial First Level - 2D Fundamentals"**, Schroff Development Corp, 2015.*

2 *Donald Watson, "**Time-Saver Standards for Building Materials & Systems: Design Criteria and Selection Data**", Tata McGraw Hill Education, 2009.*

3 ***"National Building Code of India 2016"**, Reprint edition, Bureau of Indian Standards, Govt. of India,*

4 *IS 962:1989 Code of practice for architectural and building drawings.*

5 *IS:7973 : 1976 code of practice for architectural and building working drawings.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Access the types of buildings, building regulations, paper sizes and tools for standard building drawing.

CO2: Apply National Building Code, practice bye-laws and various IS codes relevant to construction drawings

CO3: Prepare the plan and elevation of buildings according to Indian standards.

CO4: Draw the plan, elevation and sectional views with the aid of software

CO5: Perform BIM Modelling of various structural elements.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H									M				M		
CO2	L				L					M				M		
CO3	L	M	H		M									L	M	
CO4	M	H	M		H									L		L
CO5	H	M	M		H									M	L	M
18CEE 508	H	H	M		H					M				M	M	

L-Low, M-Moderate (Medium), H- High

18CPC601	STRUCTURAL ANALYSIS II	SEMESTER VI

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES302 Engineering Mechanics for Civil Engineers
2 18CPC303 Strength of Materials
3 18CPC502 Structural Analysis I

COURSE OBJECTIVES:

* To apply the concepts of slope deflection method and moment distribution method.
* To enhance the ability of students to analyze beams, frames and trusses using classical methods and matrix methods.
* To impart knowledge on matrix stiffness and matrix flexibility method.

UNIT – I : SLOPE DEFLECTION METHOD (9 Periods)

Analysis of continuous beams - Sinking of Supports – Analysis of single storey and single bay rectangular frames with and without sway.

UNIT – II : MOMENT DISTRIBUTION METHOD (9 Periods)

Distribution factor - Carry over factor – Analysis of continuous beams – Sinking of Supports – Analysis of single storey and single bay rectangular frames with and without sway.

UNIT – III : ANALYSIS OF FRAMES AND TRUSSES (9 Periods)

Analysis of multistoried building frame for vertical loads by two cycle moment distribution method - Analysis of multistoried building frame for horizontal loads by portal method.

Analysis of plane trusses with maximum two redundant members by displacement and force methods –Trusses with lack of fit –Thermal Stresses –Analysis of Space trusses using method of tension coefficients.

UNIT – IV : MATRIX FLEXIBILITY METHOD (9 Periods)

Analysis of continuous beams, indeterminate frames and trusses with maximum two degrees of static indeterminacy. MATLAB basic programming (Assignment Only)

UNIT – V : MATRIX STIFFNESS METHOD (9 Periods)

Analysis of continuous beams, indeterminate frames and trusses with maximum three degrees of kinematic indeterminacy. MATLAB basic programming (Assignment Only)

Contact Periods: Lecture: 45 Tutorial: 00 Practical:00 Total : 45 Periods

TEXT BOOKS:

1 *Punmia B.C,* ***"Strength of Materials and Mechanics of Structures, Vol.II."****, Standard Publishers, 2007.*
2 *Pandit.G.S.andGuptaS.P.,* ***"Theory of Structure, Vol.I"****, TataMcGraw–Hill,NewDelhi, 2003.*
3 *Vaidyanathan.R, Perumal.P.,* ***"Structural Analysis II"****, Laxmi Publications, 2017.*
4 *NPTEL notes - https://nptel.ac.in/courses/105105109.*

REFERENCE BOOKS:

1 *Manickaselvam.V.K,* ***"Elementary Matrix Analysis of Structures"****, Khanna Publishers, New Delhi, 1998.*
2 *Bhavikatti.S.S,* ***"Structural Analysis"****, Vol.I and II, Vikas Publishing House Pvt. Ltd., 2008.*
3 *Negi, L.S. and Jangid, R.S,* ***"Structural Analysis"****, 6th Edition, Tata McGraw-Hill Publications, 2003.*
4 *Reddy.C.S,* ***"Basic Structural Analysis"****, Third Edition, Tata McGraw-Hill Publications, 2011.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Analyse beams and frames using slope deflection method.
CO2: Analyse beams and frames using moment distribution methods.
CO3: Analyse frames, plane trusses and space trusses.
CO4: Analyse beams, frames and trusses by flexibility methods.
CO5: Analyse beams, frames and trusses by Stiffness methods.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	L	L	--	--	--	--	--	--	--	M	--	H	M	L
CO2	H	H	L	L	--	--	--	--	--	--	--	M	--	H	M	L
CO3	H	H	L	L	--	--	--	--	--	--	--	M	--	H	M	M
CO4	H	H	L	L	L	--	--	--	--	--	--	M	--	H	M	M
CO5	H	H	L	L	L	--	--	--	--	--	--	M	--	H	M	M
18CPC 601	H	H	L	L	L	--	--	--	--	--	--	M	--	H	M	M

L-Low, M-Moderate (Medium), H-High

18CPC602	FOUNDATION ENGINEERING	SEMESTER VI

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC504 Mechanics of Soils

COURSE OBJECTIVES:

1 To acquire knowledge on the soil investigation and exploration techniques.
2 To evaluate the bearing capacity and settlement of foundations.
3 To calculate the load carrying capacity of pile and pile groups and to design pile foundation.
4 To improve the knowledge of slope stability and earth pressure.

UNIT – I : SELECTION OF FOUNDATION AND SOIL EXPLORATION (09 Hours)

Types of foundation – Requirements of good foundation – Factors governing location and depth – Choice of types of foundation. Soil exploration – Objectives – Planning – Number and spacing of Boreholes –Methods of Exploration– Depth of exploration – Samples –Disturbed and undisturbed – Samplers – Soundings – SPT – SCPT – DCPT – Bore log.

UNIT – II : BEARING CAPACITY (09 Hours)

Bearing capacity – Terzaghi's bearing capacity theory – Types of failures – Effect of water table – Correction for size, shape and depth – Skempton's formula – Meyerhoff's formula – Hansen's formula – Inclination of load and eccentricity of load on bearing capacity – BIS formula –Bearing capacity from in-situ tests – Methods of improving bearing capacity.

UNIT – III : SETTLEMENT AND DESIGN OF FOUNDATION (09 Hours)

Settlement – Immediate and time dependent settlements– Differential settlement – Causes – Effect - Control–Permissible settlement–BIS code provisions–Contact pressure distribution –Proportioning– Isolated footing, combined footing and strap footing–raft foundation–Types-Floating foundation.

UNIT – IV : PILE FOUNDATIONS (09 Hours)

Classification and Selection of piles – Functions – Merits – Load carrying capacity –Static and dynamic formulae – Pile load test – Capacity from penetration test –Pile groups – Efficiency – Feld's rule –Converse Labarre formula – Spacing and group action – Efficiency of pile group – Settlement – Negative skin friction –Under reamed pile foundation.

UNIT – V : STABILITY OF SLOPES AND EARTH PRESSURE (09 Hours)

Stability of slopes – Types of slopes and failure mechanisms – Analysis of finite and infinite slope- Types of failure – Slip circle method – Friction circle method –Stability numbers and charts.
Lateral earth pressure – Plastic equilibrium – Rankine's theory – Surcharge – Inclined backfill – Stratified backfill – Coulomb's theory – Earth pressure on retaining walls of simple configurations – Graphical constructions (Rebhan's and Culmann's graphical procedure) – Stability analysis of retaining wall – Drainage of backfill.

CONTACT PERIODS: Lecture: 45 Tutorial: 00 Practical:00 Total : 45 hrs.

Text Books:

1 *Varghese P.C., "Foundation Engineering", Prentice Hall of India Pvt. Ltd., New Delhi, 2006.*
2 *Venkatramiah.C., "Geotechnical Engineering", New Age International (P) Ltd. publishers, NewDelhi, 2006.*
3 *NarasimhaRao A.V and Venkatramaiah C., "Geotechnical Engineering", Universities Press (India) Limited, 2000.*

Reference books:

1 *Teng. W.L., "Foundation Design" Prentice Hall of India Ltd., New Delhi, 1969.*
2 *ShashiK.Gulhati and Manoj Datta, Geotechnical Engineering", Tata McGraw Hill Publishing Company Ltd., NewDelhi, 2005.*
3 *Tomlinson M.J., "Foundation Engineering", Wiley Eastern Ltd., 1980.*
4 *Joseph E., Bowles, "Foundation Analysis and Design", McGraw Hill publishing Co., 1986.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Execute the various methods of soil exploration, field testing and prepare soil investigation report based on the site investigation/exploration techniques.
CO2: Estimate the bearing capacity of soils.
CO3: Calculate settlement and to design various types of foundation.
CO4: Select piles for different conditions and calculate the load carrying capacity.
CO5: Analyse stability of slopes and calculate earth pressure on retaining walls.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	M	M		M		M	M	M	L	M		H	H	M
CO2	H	H	M	M		L		M	L		L	M		H	H	M
CO3	H	H	M	M		L		M	L		L	M		H	H	M
CO4	H	H	L	M								M		H	M	L
CO5	H	H	L	M								M		H	M	L
18CPC 602	H	H	M	M		L		M	L	M	L	M		H	H	M

L-Low, M-Moderate (Medium), H-High

18CPC603	WATER RESOURCES ENGINEERING	SEMESTER VI

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC306 Water Supply Engineering

COURSE OBJECTIVES:

* To know the hydrological cycle in earth system and importance of reservoir planning.
* To have a knowledge in the design of wells under different aquifer conditions.
* To understand the design of canals in water distribution and river control.

UNIT – I : SURFACE WATER HYDROLOGY (9 Periods)

Hydrological Cycle – Precipitation – forms and types – Average rainfall over a basin - Arithmetic mean, Thiessen polygon and Isohyetal method - missing precipitation – optimum numbers. Abstractions from Precipitation - Runoff process - Estimation of Surface Runoff - Empirical formulae, Infiltration Indices and Unit Hydrograph method – Flood estimation by Empirical formulae - Rational formula – Recurrence interval – Importance of rainwater harvesting.

UNIT – II : RESERVOIR PLANNING (9 Periods)

Purpose of storage work – types of reservoirs – Investigation for reservoir planning – Selection of site for a reservoir –Yield of a reservoir – Safe, secondary and average yield – mass curve and demand curve - Calculation of safe yield from a reservoir of a given capacity- Determination of reservoir capacity for a specified yield – Zones of storage in reservoirs – Reservoir sedimentation and their control – trap efficiency - Basics of flood routing.

UNIT – III : GROUND WATER HYDROLOGY (9 Periods)

Occurrence of ground water – types of aquifers – Storage coefficient – coefficient of transmissibility and permeability – types of open and tube wells. Steady radial flow into a well - Yield estimation of unconfined and confined aquifers – Yield from an open well by constant level pumping test and recuperation test – well loss - Site selection for a tube well – Problems.

UNIT – IV : DISTRIBUTION SYSTEM (9 Periods)

Classification of Canals – canal alignment – Design procedure for an unlined irrigation channel - Kennedy's theory –Wood table – Lacey's theory – Comparisons of the two theories – Uses of Garret's diagram in channel design – Balancing depth of cutting – component parts of a canal cross section – design of lined canals – Problems.

UNIT – V : WATER LOGGING, DRAINAGE AND RIVER CONTROL (9 Periods)

Water logging – Causes and effects of water logging – Remedial measures – Land Drainage – Advantages – Types of drainage system – layout of tile drainage. Rivers – classifications – Meandering and cut-off – River training works - Objectives – Classification and Types of river training works.

Contact Periods: Lecture: 45 Tutorial: 00 Practical:00 Total : 45 Periods

TEXT BOOKS:

1 *Punmia .B.C. and Pande B. B.Lal, **"Irrigation and Water Power Engineering"**, Laxmi Publications Pvt.Ltd, New Delhi, 2016.*

2 *Santosh Kumar Garg, **"Irrigation Engineering and Hydraulics Structures"**, Khanna Publications Pvt.Ltd, New Delhi, 2017.*

REFERENCE BOOKS:

1 *Duggal .K.N and Soni. J.P, **"Elements of Water Resources Engineering"**, New Age International Pvt. Ltd, NewDelhi, 2011.*

2 *Gupta. B. L and Amit Gupta, **"Water resources System and Management"**, Standard Publishers Distributors, New Delhi, 2008.*

COURSE OUTCOMES:

On Completion of the course, the students will be able to:

CO1: Explain the hydrological cycle, equations and its components.
CO2: Fix the reservoir capacity and their yield predictions for a demand.
CO3: Conduct the yield tests in open and tube wells in real fields.
CO4: Design the section of lined and unlined channels.
CO5: Identify the remedy for water logging, importance of drainage and river control works.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M		L		L	L				L	L		H	M	
CO2	M	M	L	M	L	L	M					L		H	L	
CO3	M	M	L	M	L	L	M					L		H	L	
CO4	H	M	H	L	L	L	L					L		H	M	M
CO5	H	M		L		L	L				L	L		H	M	L
18CPC 603	H	M	L	L	L	L	L				L	L		H	M	M

L-Low, M-Moderate (Medium), H-High

18CPC607	TRANSPORTATION ENGINEERING LABORATORY	SEMESTER VI

Category : PC

L	T	P	C
0	0	3	1.5

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart practical knowledge on testing of aggregates.
- To familiarise with the testing procedures of bitumen and mix design of bituminous concrete.
- To gain practical knowledge on traffic related studies and conduct traffic surveys.

LIST OF EXPERIMENTS

TESTS ON AGGREGATES

1. Aggregate Impact value test
2. Aggregate Crushing value test
3. Ten percent fines test
4. Flakiness and Elongation Index Test
5. Attrition and Abrasion test
6. Specific gravity and Aggregate Gradation Test
7. California Bearing ratio test

TESTS ON BITUMINOUS MATERIALS

1. Penetration test on Bitumen
2. Viscosity test on Bitumen
3. Ductility test on Bitumen
4. Softening Point test on Bitumen
5. Binder content of Bitumen
6. Marshal Method of Mix Design

TRAFFIC STUDIES

1. Roadway capacity study
2. Spot speed study
3. Traffic volume study

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 45 Total : 45 Periods

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Conduct strength tests, shape test, toughness test on Aggregates.
CO2: Determine the strength of subgrade soil.
CO3: Conduct quality control tests on Bitumen.
CO4: Carry out Bitumen mix design.
CO5: Conduct Traffic surveys

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L		L									M	M		
CO2	H	L		L									M	M		
CO3	H	L		L								L	M	M	L	
CO4	H	M	L	M								L	L		L	
CO5	H	M		L	L				M	L			L			
18CPC 607	H	L	L	L	L				M	L		L	M	M	L	

L-Low, M-Moderate (Medium), H-High

18CEE608	CONCRETE AND STRUCTURAL ANALYSIS LABORATORY	SEMESTER VI

Category : EEC

L	T	P	C
0	0	4	2

PRE-REQUISITES:

1 18CES403 Construction Materials and Technology

COURSE OBJECTIVES:

* To learn the testing procedures of cement and concrete as per IS codal provisions.
* To carry out the strength and quality tests on concrete.
* To determine the forces and displacements in trusses, arches and frames.

LIST OF EXPERIMENTS

PART A: Concrete Laboratory

1. Tests on Cement
2. Tests on Concrete - Fresh Concrete Properties
3. Tests on Concrete - Hardened Concrete Properties
4. Tests on Self Compacting Concrete
5. Non Destructive Testing on Concrete

PART B: Structural Analysis Laboratory

1. Experiments on Simple steel trusses
2. Experiments on Arches
3. Experiments on beams and columns
4. Experiments on Portal Frames

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 60 Total : 60 Periods

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Determine the properties of cement.
CO2: Determine the properties of fresh and hardened concrete.
CO3: Carryout Non Destructive evaluation of Concrete.
CO4: Conduct experiments on Simple steel trusses and Arches.
CO5: Conduct experiments on Beams, Columns and Frames.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	--	L	H	--	--	--	--	--	--	--	--	M	M	L	--
CO2	M	--	L	H	--	--	--	--	--	--	--	--	M	M	L	--
CO3	M	L	L	H	M	--	--	--	--	--	--	--	--	M	M	--
CO4	M	M	--	H	M	--	--	--	--	--	--	--	--	M	M	--
CO5	M	M	--	H	M	--	--	--	--	--	--	--	--	M	M	--
18CEE 608	M	M	L	H	M	--	--	--	--	--	--	--	M	M	M	--

L-Low, M-Moderate (Medium), H-High

18CPC701	CONSTRUCTION MANAGEMENT	SEMESTER VII

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES403 Construction Materials and Technology

COURSE OBJECTIVES:

* To learn the basic concepts of management and software applications in construction projects.
* To plan, schedule and execute the construction projects based on materials, equipment, manpower and cost management.
* To get exposure on cost management and software applications in project management.

UNIT – I : BASIC CONCEPTS IN MANAGEMENT (9 Periods)

Principles of Management – Role of project manager – Types and phases of construction projects – Functions of Management – Types of organization – Types of Business Operations – Project delivery methods– Quality control and Quality assurance.

UNIT – II : CONSTRUCTION PLANNING AND SCHEDULING (9 Periods)

Construction Planning – Pre-tender planning, Preconstruction planning and Detailed construction planning – Work Breakdown Structure – Estimation of activity duration.
Scheduling – Scheduling techniques – Bar charts – Network techniques – Critical Path Method – PERT – Line of Balance method – Precedence Network Analysis – Crashing of Cost and Time – Resource Allocation and Leveling.

UNIT – III : MATERIALS AND EQUIPMENT MANAGEMENT (9 Periods)

Materials Management – Functions – Materials Planning – Procurement – Inventory Control – ABC analysis, VED analysis, FSN analysis, SDE analysis and HML analysis.
Construction Equipment – Earth-moving equipment, Dewatering, Compactors, Concrete mixing, transporting and placing, Hauling and Hoisting equipment– Buying versus leasing of construction equipment.

UNIT – IV : HUMAN RESOURCE MANAGEMENT (9 Periods)

Scope and objectives of HRM – Manpower policy and planning – Recruitment and selection – Training Performance appraisal – Wage Policy and Compensation systems – Company union relationship and Collective bargaining – Accidents – Absenteeism and Labour Turn over – Grievances/Conflicts – Identification and resolution.

UNIT – V : COST MANAGEMENT ANDSOFTWARE APPLICATIONS (9 Periods)

Cost Management – Classification of construction cost – Cost coding – Cost Estimation – Project Budget – Financial accounting systems – Cost control – Cash flow. **Software Applications –** Project management software – Introduction to MS project, Primavera and Building Information Modelling software.
Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 Periods

TEXT BOOKS:

1 *Chitkara, K.K., **"Construction Project Management Planning, Scheduling and Controlling"**, Tata McGraw-Hill Publishing Company Ltd., 2014.*
2 *Subramanian, **"Construction Management"**, Anuradha Publications, 2007.*

REFERENCE BOOKS:

1 *Kumar Neeraj Jha, **"Construction Project Management: Theory and Practices"**, Pearson Publications, 2015.*
2 *Sidney M. Levy, **"Project Management in Construction"**, Tata McGraw Hill Company Ltd., 2013.*
3 *Peurifoy R L, **"Construction Planning Equipments and Method"**, Tata McGraw Hill Publication, New Delhi, 2010.*
4 *Sharma .S.C., **"Construction Engineering and Management"**, Khanna Publishers, 2008.*

COURSE OUTCOMES:

On completion of the course, the students will able to

CO1: Apply the basic concepts of management to execute the construction works with the available resources.
CO2: Plan and schedule the construction projects at resource constraints using network techniques
CO3: Utilize the materials, equipment, manpower and cost effectively in construction industry.
CO4: Prepare project budget and cost estimation by considering cost control techniques in executing the project.
CO5: Manage the resources using project management software tools.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L	L	--	--	--	--	--	L	L	--	L	H	L	M	L
CO2	M	M	L	L	--	--	--	--	--	L	L	L	L	L	H	M
CO3	M	L	--	L	L	--	L	--	L	L	M	L	H	L	M	M
CO4	M	L	L	L	L	H	--	L	L	L	L	L	M	L	L	L
CO5	M	M	L	L	L	--	--	--	--	L	M	L	H	L	M	L
18CPC 701	M	M	L	L	L	H	L	L	L	L	M	L	H	L	M	M

L-Low, M-Moderate (Medium), H-High

18CPC702	ENGINEERING ECONOMICS ESTIMATION AND COSTING	SEMESTER VII

Category : PC

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES403 –Construction Materials and Technology.
2 18CEE507 – Computer Aided Civil Engineering Drawing.

COURSE OBJECTIVES:

* To address the economic concepts, theories and analytical techniques.
* To familiarize in estimation, analysis of rates, tendering and valuation of various items.

UNIT – I : DEFINITION AND SCOPE OF ECONOMICS (9 Periods)

Definitions: Economics and their critical examination - Nature and scope of Economics - Micro-economics- Demand, Factors influencing demand, Elasticity of demand - price, income and cross, concepts and measurement - Break Even Analysis – Law of Demand - Price, income and substitution effects - Giffen goods- Pricing Methods.

UNIT – II : ESTIMATION FUNDAMENTALS (9 Periods)

Importance of estimation, different types of estimates, general and detailed specifications. Methods of Estimation - Methods of building estimate – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C, PCC Doors, Windows, Flooring, White Washing, colour washing and painting for load bearing structures and framed structures.

UNIT – III : RATE ANALYSIS AND COST ESTIMATE OF BUILDINGS (9 Periods)

Data – Types of Data – Scheduled of rates – lead statement – Theoretical materials – Requirement calculations - Analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works-Estimation of Roofs – R.C.C. slab roof ,Tiled Roof, Roof Truss. Estimation of R.C.C. works – Beam, T-beam and Slab, Column, Foundation, Stair case, Retaining wall etc.

UNIT – IV : DETAILED ESTIMATION OF BUILDINGS AND TENDERS (9 Periods)

Preparation of detailed estimate for RCC single storey and two storeys residential framed structures - Estimates of Steel Framed Industrial Buildings. Tenders – E-Tendering - Contracts – Types of Contracts – Arbitration and Legal Requirements.

UNIT – V : VALUATION (9 Periods)

Valuation – Valuation Scenario in India – Valuation Methods and Practices – Market Value – Book Value – Scrap Value – Salvage Value – Annuity – Capitalized Values – Sinking Fund – Depreciation – Methods of Valuation - Valuation of a Building – Rent Fixation – Mortgage – Lease– Current Standards for Valuation (Not for Examination).

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 Periods

TEXT BOOKS:

1 *KohliD.D.AndKohli R.C.,* ***"A Text Book On Estimating, Costing (Civil)"****, S.Chand and Co, New Delhi, 2013.*
2 *Dutta, B.N.,* ***"Estimating And Costing in Civil Engineering"****, UBS Publishers & Distributors Private (Ltd) 2012.*
3 *Chakraborti.M,* ***"Estimation, Costing, Specifications and Valuation in Civil Engineering"****, 2006*
4 *Ahuja H.L.,* ***"Economic Environment of Business, Macroeconomic analysis"****, S.Chand & Company Ltd., New Delhi, 2005.*
5 *Ruddar Datt and K.P.M.Sundharam,* ***"Indian Economy"****, S.Chand & Company Ltd., New Delhi, 2003.*

REFERENCE BOOKS:

1 *CPWD Specifications and Schedule of Rates.*
2 *PWD Data Book.*
3 *Tamilnadu Transparencies in Tender Act, 1998*
4 *Standard Bid Evaluation Form, Procurement of Goods or Works, The World Bank, April 1996.*
5 *Standard data book for analysis and rates, IRC, New Delhi, 2003.*
6 *B.S.Patil,* ***" Civil Engineering Contracts and Estimates"****, University Press, 2006*
7 *Jagannathan, G.* ***"Getting more at less cost – The value engineering way"****, Tata McGraw Hill Publishing company, New Delhi, 2000.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Apply the main concepts and describe the methods in economic analysis

CO2: Prepare estimation for different construction activities and building works.

CO3: Perform detailed rate analysis for construction works

CO4: Assign work to suitable contractor by inviting bid.

CO5: Select a suitable method of valuation for different types of buildings

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L			L	L		L		M	H	L	L	M	H	H
CO2	H	M	M		M				L			L	M	H	H	H
CO3	H	M	L		L	M	L				H	L	M	M	H	M
CO4	H	M	M	L							M	L	M	H	H	H
CO5	H	M	H	L	L	L	M	L		L	H	L	L	M	H	M
18CPC 702	H	M	M	L	L	L	M	L	L	L	H	L	M	H	H	H

L-Low, M-Moderate (Medium), H-High

18CPC703	PRESTRESSED CONCRETE STRUCTURES	SEMESTER VII

Category : PC

	L	T	P	C
PRE-REQUISITES:	**3**	**0**	**0**	**3**

1 18CPC503 Basic Structural Design II (Concrete)

COURSE OBJECTIVES:

* To gain exposure about the basic concepts, principles and methods of prestressing.
* To familiarize with the determination of shear strength and ultimate shear resistance capacity as per IS code.
* To get knowledge about losses in prestress and anchorage zone stresses.
* To be acquainted with the codal provisions for the design of prestressed concrete elements, pipes and liquid retaining structures.
* To understand the design concepts of composite constructions

UNIT – I : INTRODUCTION (9 Periods)

Principles – Pretensioning – Post – tensioning – Advantages and Types of prestressing – systems of prestressing –Materials for prestressed concrete - Theory and behaviour of prestressed concrete beams in bending – calculation of fibre stresses for various section (Rectangle, I, T) of simply supported beam - Stress method – Moment of resistance method – Load balancing method. Various losses in prestressed concrete members – Deflection of prestressed concrete flexural members – calculation of long term deflection.

UNIT – II : DESIGN OF PRESTRESSED CONCRETE BEAMS (9 Periods)

Pre tensioned and post tensioned simply supported rectangle, I, T sections – Stress method – Design for flexure, bond and shear – Introduction to End block – Transmission length – End zone reinforcement – Anchorage zone stresses-Guyon and Magnel's method – Analysis and design of end block.

UNIT - III : DESIGN OF TENSION AND COMPRESSION MEMBERS (9 Periods)

Design of prestressed tension members subjected to axial load – Design of prestressed compression members– Design of sleepers and poles.

UNIT - IV : CIRCULAR PRESTRESSING (9 Periods)

Analysis and Design of circular pipes – Design of cylindrical water tanks.

UNIT – V : COMPOSITE CONSTRUCTION (9 Periods)

Types of composite construction – Transformation of composite sections – flexural analysis of composite simply supported beams – Differential Shrinkage - Limit state design criteria – partial prestressing – Non- prestressed reinforcements

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 Periods

TEXT BOOKS:

1 *Krishnaraju.N,* ***"Prestressed concrete"****, 6th edition, Tata McGraw Hill Publishing company Ltd., New Delhi, 2018.*
2 *Sinha. N.C and Roy.S.K,* ***"Fundamentals of prestressed concrete"****, S.Chand and Co. Ltd 2011.*
3 *Muthu K. U., Ibrahim Azmi, Janardhana Maganti, Vijayanand M,* ***"Prestressed Concrete"****, PHI Learning Pvt. Ltd., 2016.*
4 *NPTEL notes - https://nptel.ac.in/courses/105106117.*

REFERENCE BOOKS:

1 *Lin .T.Y., and Ned H. Burns.,* ***"Design of prestressed concrete structures"****, John Wiley & Sons, International Edition, New York, 2015.*
2 *Dayaratnam.P.,* ***"Prestressed Concrete Structures"****, Oxford and IBH Publishing Company pvt, Ltd, New Delhi, 2008.*
3 *N.Rajagopalan,* ***"Prestressed Concrete"****, Narosana Publications, 2006.*
4 *Guyon, Y.* ***"Limit State Design of Prestressed Concrete Vols. I & II"****, Applied Science Publishers, London, 1974.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Describe the systems and obtain the internal forces due to prestressing.
CO2: Propose an appropriate system to prestress a particular structure and to design the prestressed concrete beam elements and end blocks.
CO3: Design tension and compression prestressed concrete members, pipes & liquid retaining structures.
CO4: Evaluate the initial and time dependent losses and deflection of prestressed elements
CO5: Determine the resultant stresses of composite section.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	M		M	M	L	M	M	M	M	M	L	H	M	M
CO2	H	M	M	L		L		M	M			M	L	H	M	
CO3	H	H	H	M		L		M			M	M	L	H	M	M
CO4	H	H	H	L		L		M			H		L	H	M	
CO5	H	H	H	M	M	M		M				M	L	H	M	M
18CPC 703	H	H	H	M	M	M	L	M	M	M	H	M	L	H	M	M

L-Low, M-Moderate (Medium), H-High

18CPC707	COMPUTER APPLICATIONS LABORATORY	SEMESTER VII

Category : PC

L	T	P	C
0	0	3	1.5

PRE-REQUISITES:

1 18CPC404 Basic Structural Design – I (Steel)
2 18CPC503 Basic Structural Design – II (Concrete)

COURSE OBJECTIVES:

* To familiarize with the programming skills for analysis and design of structures.
* To gain exposure about the modern computing tools to formulate analyze and design of various concrete and steel structures.
* To get knowledge about the behaviour of structural systems using the software packages.
* To understand the behaviour and design of members subjected to various loading cases.
* To learn the analysis and design of various 2D & 3D Truss and Frames.

ANALYSIS OF STRUCTURES USING SOFTWARE
Trusses, Frames and Water tanks.

DESIGN OF STRUCTURAL ELEMENTS USING EXCEL SPREADSHEET

DETAILING OF STRUCTURAL ELEMENTS USING AUTOCAD

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 45 Total : 45 Periods

TEXT BOOKS:

1 *Krishnamoorthy C.S., and Rajeev S., **"Computer Aided Design and Analytical tools"**, Narosa., 2000.*
2 *Isaac D. Gottlieb, **"Next Generation Excel, 2nd edition"**, Wiley India Pvt. Ltd., 2013.*
3 *Gaurav Verma, ETABS 2016 Black Book, CAD/CAM/CAE Works, 2018.*
4 *Dr. P. Vinayagam, **"Analysis & Design of Structures using STAAD.Pro"**, Vaghai Publishers, 2011.*

REFERENCE BOOKS:

1 *WebTech Sol., **"Mastering Microsoft Excel Functions and Formulas"**, Khanna Publishers, 2013.*
2 *D. Rajendran , **"Learn STAAD.Pro"**, Design Tech Publishers, 2004.*
3 *Dr.M.N.Shesha Prakash, Dr.G.S.Suresh, **"Reference Book on Computer Aided Design Laboratory"**, Laxmi Publications (P) Ltd., 2010.*

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Recognize the design philosophy of structural components
CO2: Follow IS codes for the calculation of different types of loads and to analyze the structural systems under gravity and lateral loads.
CO3: Apply the principles, procedures and current code requirements to the analysis and design of steel and reinforced concrete structures.
CO4: Identify and compute the design loads on industrial structures.
CO5: Identify the behavior of structural systems by using the software packages.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	M	--	--	--	--	--	--	--	M	M	M	H	M
CO2	H	M	L	L	--	--	--	--	--	--	--	L	--	H	H	M
CO3	H	M	L	L	--	--	--	--	--	--	--	L	L	H	H	M
CO4	H	L	L	L	--	--	--	--	--	--	--	L	L	H	M	M
CO5	H	M	M	M	H	--	--	--	--	--	--	L	L	H	H	M
18CPC 707	H	M	L	L	H	--	--	--	--	--	--	L	L	H	H	M

L-Low, M-Moderate (Medium), H-High

18CEE708	MINI PROJECT	SEMESTER VII

Category : EEC

L	T	P	C
0	0	8	4

PRE-REQUISITES:

All Civil Engineering Subjects

COURSE OBJECTIVES:

* To gain knowledge on literature survey to identify the problem statement.
* To learn about the methodology in project execution.
* To get exposure on report preparation and presentation skills..

COURSE CONTENT:

It will be assigned by the Department for maximum of four students in a group, under the guidance of a Supervisor. This course envisages a design problem or experimental work in any one of the disciplines of Civil Engineering.

The Mini Project includes:

* Survey and collection of relevant data on the assigned topic
* Working out a preliminary Drawings to the Problem relating to the topic
* Conducting preliminary & detailed Analysis / Modelling / Simulation / Design / Feasibility
* Preparing a Written Report on the Study conducted
* Final Seminar, as oral Presentation before a Departmental Committee

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 120 Total: 120 Periods

COURSE OUTCOMES:

On completion of the course, Students will be able to

CO1: Identify Civil Engineering Analytical Problems based on present scenario.
CO2: Apply the standards and codal provisions for execution of the project work
CO3: Analyse/Model, design &prepare drawings.
CO4: Calculate bill of quantities and approximate project cost.
CO5: Prepare the final detailed mini project report along with presentation document.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	L	M	H	H	H	M	H	H	H	H	M	M	M	M
CO2	H	M	H	L	H	M	H	L	H	M	M	H	L	H	H	M
CO3	H	H	H	H	H	M	M	H	H	M	M	H	M	H	H	L
CO4	H	H	H	M	H	L	L	L	H	H	H	H	L	H	H	M
CO5	H	L	L		H	L	L	H	H	H	H	M	L	L	L	L
18CEE 708	H	H	H	M	H	M	H	H	H	H	H	H	L	H	H	M

L-Low, M-Moderate(Medium), H-High

18CEE803	PROJECT WORK	SEMESTER VIII

Category : EEC

L	T	P	C
0	0	16	8

PRE-REQUISITES:

All Civil Engineering Subjects

COURSE OBJECTIVES:

- To get exposure on literature collection from various sources and to identify the problem from critical review.
- To impart expertise in the broad field of Civil Engineering, either fully theoretical/Practical or involving both Theoretical and Practical work..

COURSE CONTENT:

It will be assigned by the Department for maximum of four students in a group, under the guidance of a Supervisor. During this period the students shall receive directions from the Supervisor for the progress of the Project Work. The students shall give periodical presentations of the progress made in the Project Work. Each student shall finally produce a comprehensive report. This final report shall be typewritten form as specified in the guidelines.

The Project Work shall be carried out in any of the Civil Engineering areas such as Construction Engineering, Structural Engineering, Environmental Engineering, Water Resources Engineering, Transportation Engineering, Geo Technical Engineering and Remote sensing.

The Project Work includes:

- Review and finalization of the Approach to the Problem
- Preparing an Action Plan for conducting the investigation, including team work
- Detailed Analysis/ Modelling /Simulation/Design/Problem Solving/Experiment as needed
- Final development of product/process, testing, results, conclusions and future directions
- Preparing a paper for Conference presentation/Publication in Journals, if possible
- Preparing a Dissertation in the standard format for being evaluated by the Supervisor
- Final Seminar Presentation before a Departmental Committee

Contact Periods: Lecture: 00 Tutorial: 00 Practical: 240 Total: 240 Periods

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Identify Specific Civil Engineering area and work for the real life needs.
CO2: Familiarize with the Standard Codes for specific Civil Engineering works.
CO3: Apply latest techniques to analyze, Modelling & Simulation work.
CO4: Give practical solutions to Civil Engineering Problems.
CO5: Prepare the final detailed report.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	L	M	H	H	H	M	H	H	H	M	H	M	H	M
CO2	H	M	H	L	H	M	H	L	M	M	L	H	L	H	M	M
CO3	H	H	H	H	H	M	M	H	M	M	M	H	M	M	H	L
CO4	H	M	H	M	M	L	L	L	H	H	H	M	L	M	H	M
CO5	M	L	L	M	H	H	M	L	M	H	H	M	L	L	M	L
18CEE 803	H	M	H	M	H	H	H	L	M	H	H	M	L	M	H	M

L-Low, M-Moderate (Medium), H-High

18CPE$01	STEEL STRUCTURES

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CBS203 - Mechanics and Properties of Solids
2 18CPC303 – Strength of Materials
3 18CPC404 – Basic Structural Design I (Steel)

COURSE OBJECTIVES:

* To study the behaviour and design of Beam Column subjected to eccentric force and design of base plate.
* To study the design of Gantry girder, welded plate girder, stiffeners and connections.
* To understand the behaviour of cold formed steel.
* To introduce the concept of plastic analysis and Corrosion and fire resistant design.

UNIT – I : PLASTIC ANALYSIS (9 Periods)

Introduction to Plastic analysis - ductility - plastic bending of beams - stages of bending - shape factor - plastic hinge - load factor - failure mechanism - upper and lower bound theorems of plastic analysis - collapse load for beams and frames.

UNIT – II : BEAM COLUMNS (9 Periods)

Introduction to beam - column behaviour - equivalent moment factor - strength interaction - design of beam column - beam - column subjected to tension and bending - moment resistant base plate.

UNIT – III : PLATE GIRDERS AND GANTRY GIRDERS (9 Periods)

Analysis and Design of Welded plate girders – curtailment of flange plates –stiffeners – Splices - analysis and design of gantry girder.

UNIT – IV : COLD FORMED STEEL STRUCTURES (as per IS Codes) (9 Periods)

Types of cross sections-concepts of local buckling, and Effective width-Design of compression and tension members- concepts of lateral buckling –Design of Beams. (Simple Problems only)

UNIT – V : CORROSION AND FIRE RESISTANT DESIGN (9 Periods)

Corrosion Protection : Introduction - Corrosion of Steel - Corrosion - protection Methods - Atmospheric - Corrosion-Resistant Steels- Corrosion Allowance
Fire-resistant Design: Introduction - Fire Research - Design Curves and Fire Models - Fire Engineering Design Problems - Fire Engineering Design of Steel Structures - Calculation Approach - Calculation of Temperature Rise in Steel Members - Mechanical Properties of Steel at Elevated Temperatures - Time to reach Limiting Temperature - Passive Protection for Steelwork - Fire resistant Steels - Fire Performance Assessment.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 Periods

TEXT BOOKS:

1 *SubramanianN., **"Design of steel structures"** ,Oxford university press, 2008.*
2 *DuggalS.K., **"Limit State Design of Steel Structures"**, Tata McGraw Hill., 1st Edition, NewDelhi, 2010.*
3 ***"Teaching Resources for Structural Steel Design – Volume I and II"**, INSDAG, Kolkatta, 2009.*

REFERENCE BOOKS:

1 *Arya A.S. and Ajmani J.L., **"Design of Steel structures"** Nem Chand and Bros.Roorkee, 2000.*
2 *Ramachandra, **"Design of Steel structures"** Vol I & II. Standard Book House, New Delhi,2005.*
3 *IS:800-2007 - Code of practice for general construction in steel (Third revision).*
4 *P.Dayaratnam, **"Design of steel structures"**, S.Chand Publishers 2011-12.*
5 *M.R. Shiyekar, **"Limit State Design of Steel Structures"**, PHI Learning Private Ltd, NewDelhi, 2011.*

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Perform the plastic analysis on beams and frames.
CO2: Identify the behaviour and design of Beam Column subjected to eccentric force
CO3: Design the Gantry girder, welded plate girder, stiffeners and connections.
CO4: Design the cold formed steel structures as per IS codes
CO5: Perform Corrosion and Fire Resistant Design.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	L	L							L	M		M	L	
CO2	M	M	M	M							L	M			L	
CO3	M	H	H	H	M						L	M		H	H	M
CO4	H	H	M	M							L	M		M	H	H
CO5	M	M									L	M		M	M	M
18CPE $01	H	H	H	H	M						L	M		M	H	H

L-Low, M-Moderate (Medium), H-High

18CPE$02	CONCRETE TECHNOLOGY

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES403 – Construction Materials and Technology

COURSE OBJECTIVES:

* To learn the tests to be carried out on various concrete making materials as per IS codal provisions and to understand their properties.
* To study the properties of fresh and hardened concrete
* To know about various methods of mix design for concrete.
* To have an exposure on various special concretes.

UNIT – I : INGREDIENTS OF CONCRETE (9 Periods)

Cement – constituents- Hydration – Tests on cement – Types of cement – Aggregates – properties and uses – Classification of aggregates – Properties and test on aggregates – gradation – Quality of water – Admixtures – Chemical Admixtures and mineral admixtures.

UNIT – II : FORMWORK AND PRODUCTION OF CONCRETE (9 Periods)

Requirements of formwork – Economy in formwork – Materials for forms – Arrangement of forms for slabs, beam, column, walls, culverts, stairs etc – Removal of forms – Design considerations. Measurement of materials – batching – Mixing –Transportation – Placing of concrete in cold weather, hot weather and under water concreting – Compaction – Curing.

UNIT – III : PROPERTIES OF CONCRETE (9 Periods)

Properties of fresh concrete – Workability – Segregation – Bleeding – Test for fresh concrete properties - Properties of hardened concrete – Strength – Stress - Strain characteristics – Modulus of Elasticity – Shrinkage – Creep – Thermal properties – Permeability – Test for hardened concrete properties – Test for micro structural properties of concrete - Non-Destructive Test.

UNIT – IV : CONCRETE MIX DESIGN AND QUALITY CONTROL OF CONCRETE (9 Periods))

Quality Control - Frequency of sampling – Statistical analysis of test results – standard deviation – Coefficient of variation – Characteristic strength – Acceptance and rejection Criteria – Importance of water cement ratio – Importance of cover to concrete. Nominal mixes – Design Mixes – factors influencing the design mix – Mix Design by ACI method, IS method and DOE method.

UNIT – V : SPECIAL CONCRETES (9 Periods)

High Strength concrete - High Performance Concrete - reactive powder concrete - Light weight, heavy weight and mass concrete – Self Compacting Concrete – Self Curing Concrete – Polymer Concrete – Fibre Reinforced Concrete - Ready Mixed Concrete – Geo polymer concrete.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Shetty M.S and Jain A.K,* ***"Concrete Technology - Theory and Practice"****, S.Chand & Company, New Delhi, 2018.*
2 *Santhakumar A.R,* ***"Concrete Technology"****, S.Chand Publishers, 2018.*
3 *Gambhir M.L,* ***"Concrete Technology - Theory and Practice"****, Tata Mc-Graw Hill Company, 2013.*

REFERENCE BOOKS:

1 *IS 10262 – 2019, Concrete Mix Proportioning – Guidelines.*
2 *ACI 211.1-91, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete, American Concrete Institute.*
3 *Neville A.M* ***"Properties of Concrete"****, Pearson Education India,, 2012*
4 *Povindar K. Mehta, Paulo J. M. Monteiro,* ***"Concrete: Microstructure, Properties, and Materials"****, Mc-GrawHill Company, 2014.*

COURSE OUTCOMES:

On the Completion of the course, the students will be able to

CO1: Identify the properties and role of ingredients like cement, aggregate, admixtures in concrete.
CO2: Choose the suitable formwork for construction **.**
CO3: Infer the behavior of fresh and hardened concrete.
CO4: Proportion the concrete using various mix design concepts.
CO5: Select appropriate type of concrete for specific requirements.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		M									M	H	L		
CO2	M				M								H	L	M	
CO3	M		M	H									H	L		
CO4	M	M		H	M								H	L	M	
CO5	M					L	L					H	H	L		M
18CPE $02	M	M	M	H	M	L	L					H	H	L	M	M

L-Low, M-Moderate (Medium), H-High

18CPE$03	FINITE ELEMENT METHOD

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CBS301 Transform Calculus and Partial Differential Equations
2 18CPC303 Strength of Materials

COURSE OBJECTIVES:

* To apprise the students about the basics of Finite Element theory, computer implementation of this theory and its practical applications.
* To understand various basic energy and weighted residual methods.
* To familiarise with the principles of structural mechanics.
* To acquire knowledge on isoparametric and axisymmetric elements.

UNIT – I : INTRODUCTION (9 Periods)

Concepts of Finite Element methods – Steps involved - Advantages & Disadvantages - Direct Stiffness Method - Steps in direct method of FEA - Problems on simple beams and Trusses - Discretization – Finite Element Techniques - Variational approach – Weighted mean residual methods like Collocation method, Subdomain method, Galerkin method and Least square method – Simple problems only.

UNIT – II : ELEMENTS OF ELASTICITY (9 Periods)

Introduction – Elastic Theory – Displacements and Strains – Equilibrium – Compatibility – Constitutive law – Plane Stress - Plane Strain- Basic principles of structural mechanics– Principles of Virtual work and minimum potential energy.

UNIT – III : FINITE ELEMENTS (9 Periods)

Concept of an element - Basic element shapes - Element properties - Displacement models – Approximation displacements by Polynomials - Convergence requirements – Generalised co-ordinates – Natural co-ordinates – Shape functions for linear & quadratic models – Stiffness matrix – Nodal load vector – Static condensation – Simple problems.

UNIT – IV : INTRODUCTION TO ISOPARAMETRIC ELEMENTS (9 Periods)

Concept of sub, iso, super parametric elements – Gauss quadrature – Examples in one and two dimensional elements – Stress analysis of three Dimensional elements.

UNIT – V : AXISYMMETRICELEMENTS (9 Periods)

Analysis of solids of revolution under axisymmetric loading – Formulation of axisymmetric solid element–Simple examples - Introduction to Finite Element Software packages.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Krishnamoorthy C.S., **"Finite Element Analysis -Theory and Programming, Second Edition"**, Tata McGraw Hill Publishing Co., 2004.*

2 *Tirupathi R. Chandrupatla and Ashok D. Belugundu, **"Introduction to Finite Elements in Engineering, Third Edition"**, Prentice Hall India Pvt Ltd, 2011.*

3 *P.Seshu, **"Textbook of Finite Element Analysis"**, Prentice Hall India Pvt Ltd, 2008.*

REFERENCE BOOKS:

*1 Rajasekaran.S., **"Finite Element Analysis in Engineering Design"**, Wheeler Publishing,2008.*

*2 ChandrapatlaTirupathi.R and Belegundu, Ashok. D., **"Introduction to Finite Elements in Engineering, Second edition"**, Prentice Hall of India, 2014.*

*3 S.S.Rao, **"The Finite Element Method in Engineering"**, Buttersworth - Heinemann publishing, 2017.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Familiarize the basic concepts involved in FEM theory and acquire knowledge on direct and formal (basic energy and weighted residual) methods.

CO2: Recognize the basic principles of structural mechanics and to apply the concepts on simple structural elements.

CO3: Interpret the role and significance of shape functions in finite element formulations

CO4: Familiarize the formulation of isoparametric elements.

CO5: Analyse elements subjected to axisymmetric stresses.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		M		H											
CO2	H	M	M		H									M	M	
CO3	H	M	M	M	H	L						L		L	M	M
CO4	H	M	H		H	H						L		M	L	L
CO5	H	H	H		H	H						L		M	M	M
18CPE $03	H	M	M	M	H	H						L		M	M	M

L-Low, M-Moderate (Medium), H-High

18CPE$04	ADVANCED CONCRETE DESIGN

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC503 Basic Structural Design II (Concrete)

COURSE OBJECTIVES:

* To create an awareness on yield line theory of slabs.
* To understand the design principles of Grid floors, ribbed slabs and bunkers and silos.
* To understand the design of slender columns, RC walls, bridges and deep beams.

UNIT – I : YIELD LINE THEORY OF SLABS AND INELASTIC BEHAVIOUR OF CONCRETE BEAMS (9 Periods)

Yield line theory- Assumptions made in analysis – analysis of isotropically and orthotropically reinforced slabs – virtual work method and equilibrium method. Inelastic behaviour of concrete beams moment rotation curves –moment redistribution.

UNIT – II : DESIGN OF SPECIAL RC ELEMENTS (9 Periods)

Design of slender columns – Braced and Unbraced columns – design considerations of RC walls – design of deep beams.

UNIT – III : GRID FLOORS AND RIBBED SLABS (9 Periods)

Grid floors – design principles – analysis of grid floor by approximate method –Ribbed slabs – analysis and design of ribbed slab for moment and shear.

UNIT – IV : BUNKERS AND SILOS (9 Periods)

Design of Bunkers – Design of Silo - Detailing of reinforcements.

UNIT – V : DESIGN OF BRIDGES (9 Periods)

Types of bridges – IRC loadings – Design of single span slab bridge deck for class A loading – Design of T– beam bridge for class AA loading.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Varghese.P.C, **"Advanced Reinforced Concrete Design"**, Prentice Hall of India Private Ltd, NewDelhi, 2010.*

2 *Krishnaraju, **"Advanced Reinforced Concrete Design – S.I units"**, C.B.S., New Delhi, 2017.*

REFERENCE BOOKS:

1 *IS 456-2000, **"Indian standard code of practice for plain and reinforced concrete".***
2 *SP 34(1987), **"Handbook on Concrete Reinforcement and Detailing"**, BIS, New Delhi.*
3 *IRC 6 – 2014, Standard Specifications and Code of Practice for Road Bridges*
4 *Pillai, S. U. and Menon, D, **"Reinforced Concrete Design"**, Tata McGraw Hill, 2017*
5 *DayaratnamP., **"Design of Reinforced Concrete Structures"**, Oxford & IBH publishing Co.Pvt.Ltd., 2011.*
6 *Subramanian N, **"Design of Reinforced Concrete Structures"**, Oxford University Press, 2014.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Analyse slabs using yield line theory and understand the concepts of inelastic behaviour of beams.
CO2: Analyse and design slender columns, RC walls and deep beams as per Indian Standards.
CO3: Design Grid floors and ribbed slabs using various methods.
CO4: Design bunkers and silos.
CO5: Perform analysis and design of bridges as per Indian Standards.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	M	M					L			M	L	H	M	
CO2	H	H	M	H		L	H		L			M	H	H	H	
CO3	H	M	H	M		L			M			M	H	M	M	
CO4	H	M	H	M		L			M			M	H	H	H	
CO5	H	H	L	M		M	H		L			M	L	M	M	
18CPE $04	H	M	H	M		L	H		L			M	H	H	M	

L-Low, M-Moderate (Medium), H-High

18CPE$05	BASICS OF DYNAMICS AND ASEISMIC DESIGN OF STRUCTURES

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES302 Engineering Mechanics for Civil Engineers
2 18CBS402 Engineering Geology
3 18CPC503 Basic Structural Design II (Concrete)

COURSE OBJECTIVES:

* To learn the basics of various dynamic forces and its effects on the structure.
* To enhance the ability to identify the mode shapes of the structure under dynamic loading
* To learn the causes and effects of earthquake and its measurement.
* To enhance the ability to design an earthquake resistant structures by using IS codal provisions.

UNIT – I : THEORY OF VIBRATIONS (9 Periods)

Concept of inertia and damping – Types of damping – Difference between static forces and dynamic excitation –degrees of freedom – SDOF idealization – Equations of motion of SDOF system of mass as well as base excitation –Free vibration of SODF system – response to harmonic excitation – Impulse and response to unit impulse–Duhamel integral.

UNIT – II : MULTIPLE DEGREE OF FREEDOM SYSTEM (9 Periods)

Two degree of freedom system – Normal modes of vibration – Natural frequencies – Mode shapes – Introduction to MODF systems – Decoupling of equations of motion – Concept of mode superposition (No derivations).

UNIT – III : ELEMENTS OF SEISMOLOGY AND SEISMIC DESIGN CONCEPT (9 Periods)

Causes of earthquake – Geological faults – tectonic plate theory –Elastic rebound – Epicentre – Hypocentre – primary, shear and Raleigh waves – seismogram – magnitude and intensity of earthquake – magnitude and intensity scales– Spectral acceleration – Information on some disastrous earthquakes – concept of earthquake resistant design –strong column weak beam concept – guide lines for seismic resistant construction – effects of structural irregularities – seismic resistant building architecture.

UNIT – IV : RESPONSE OF STRUCTURES TO EARTHQUAKES (9 Periods)

Response and design spectra –Design earthquake – concept of peak acceleration – Site specific response spectrum –Effect of soil properties and damping – Liquefaction of soils – Importance of ductility – Methods of introducing ductility into RC structures.

UNIT – V : DESIGN METHODOLOGY (9 Periods)

IS 1893, IS 13920 and IS 4326 – Codal provisions – design as per the codes – Base isolation techniques – Vibration control measures – Important points in mitigating effects of earthquakes on structures.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Chopra, A.K., **"Dynamics of structures – Theory and Applications to Earthquake Engineering, Fifth Edition"**, Pearson Education, 2017.*
2 *Pankaj Agarwal & Manish Shrikhande, **"Earthquake Resistant Design of Structures"**, PHI Learning privated Limited, NewDelhi, 2011.*
3 *S.K.Duggal, **"Earth Quake Resistant Design of Structures"**, Oxford university Press, 2013.*
4 *Damodarasamy S. R, Kavitha S, **"Basics of Structural Dynamics and Aseismic Design"**, PHI Learning Private limited, New Delhi, 2009.*

REFERENCE BOOKS:

1 *Bruce A Bolt, **"Earthquakes"** W H Freeman and Company, New York, 2004*
2 *C. A. Brebbia, **"Earthquake Resistant Engineering Structures VIII"**,WIT Press, 2011*
3 *Indian Standard Codes: IS: 1893, IS: 4326 and IS:13920, Bureau of Indian Standards, New Delhi.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Determine response of SDOF System subjected to different types of vibration**..**
CO2: Determine response of MDOF System subjected to different types of vibration
CO3: Gain knowledge on elements of seismology and seismic design concept.
CO4: Analyze the structures which can overcome earthquake forces
CO5: Apply Indian codal provisions in the planning, design and detailing of structures.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M		L								M		M	M	
CO2	H	H		M		H			L	M	M	H		M	H	
CO3	M		M			M				M	M	L	L	M	M	
CO4	H		H							M	M	L	L	M	M	
CO5	H		H		L	L				M	H	L	L	M	M	
18CPE $05	H	H	H	M	L	H				M	M	M	L	M	M	

L-Low, M-Moderate (Medium), H-High

18CPE$06	CONCRETE STRUCTURES

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC404 Basic Structural Design I (Steel)
2 18CPC503 Basic Structural Design II (Concrete)

COURSE OBJECTIVES:

* To learn the types of footings, choice of foundation and its design concept.
* To learn the design procedures for complex structures like retaining walls, flat slabs and water tanks
* To make the students to know about the earthquake resistant design and ductile detailing of structures.

UNIT – I : FOOTINGS (9 Periods)

Design of Eccentrically loaded footings for columns – Combined rectangular footings – Combined trapezoidal footings for axially loaded column - Strap beam footings – Design steps of raft foundations.

UNIT – II : RETAINING WALLS (9 Periods)

Types of retaining walls – Structural behaviour of retaining walls- Stability of retaining wall against over-turning sliding and pressure developed under the base - Design of Cantilever retaining wall and Counterfort retaining wall.

UNIT – III : FLAT SLAB DESIGN (9 Periods)

Design loads other than earthquake loads (only an introduction) – Imposed loads, wind loads, construction loads. Design of Flat slabs by BIS code – Middle panel and End panel – Column strip – Middle strip – with and without column head –reinforcement details.

UNIT – IV : WATER TANKS DESIGN (WORKING STRESS METHOD) (9 Periods)

Design of underground and on ground rectangular and circular tanks – Overhead tanks of rectangular shape and circular shape with flat roof – BIS code method -Design of all components including staging and foundation

UNIT – V : EARTHQUAKE FORCES – DUCTILE DETAILING (9 Periods)

Earthquake forces – Bureau of Indian standards for Earthquake resistant design – earthquake magnitude and intensity – Basic seismic coefficients and seismic zone factors – design forces – design factors – Analysis of structures– choice of method for multistoried buildings. Ductile detailing of frames for seismic forces – general principles.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 Periods

TEXT BOOKS:

1 *Pillai and Menon, **"Reinforced Concrete Design"**, McGraw Hill Education (India) Private Ltd., 2016.*
2 *Sinha.S.N., **"Reinforced Concrete Design"**, Tata McGraw Hill publishing company Ltd., 2003.*
3 *Pankaj Agarwal and Manish ShriKhande, **"Earthquake Resistant Design of Structures"**, Prentice- Hall of India, New Delhi, 2006.*

REFERENCE BOOKS:

1 *BIS 456 – 2000, Indian Standard code of Practice for plain and Reinforced concrete.*
BIS 3370-Part 4 - Indian Standard Code of practice for concrete structures for the storage of liquids.
2 *BIS 1893-2016- Indian Standard Code of practice for Criteria for Earthquake resistant design of structures.*
3 *IS 13920(2016), Indian Standard Code of practice for "Ductile detailing of Reinforced concrete structures subjected to seismic forces".*
4 *Ramachandra, **"Design of Concrete Structures – Vol 1"**, Standard Book House, Delhi-6, 2002.*
5 *V.L.Shah and S.R.Karve **"Limit state theory and design of reinforced concrete"**, Structure Publications, 2005.*
6 *Vazirani & Ratwani, **"Design of R.C.C Structures"**, Khanna Publishers, 2006.*

COURSE OUTCOMES:

On completion of this course, Students will be able to
CO1: Make the choice of foundation and its design as per BIS code
CO2: Select the choice of retaining walls and its design as per BIS code.
CO3: Design of Flat slabs as per BIS code.
CO4: Design of various water tanks and its design as per BIS code.
CO5: Apply the provisions of earthquake resistant design and ductile detailing of structures

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L	L	L	--	--	--	--	--	L	--	--	--	H	M	--
CO2	M	L	L	L	--	--	--	--	--	L	--	--	--	H	M	--
CO3	M	L	L	L	--	--	--	--	--	L	--	--	--	H	M	--
CO4	M	L	L	L	--	--	--	--	--	L	--	--	--	H	M	--
CO5	H	L	L	L	--	--	--	--	--	L	--	--	--	H	M	--
18CPE $06	H	L	L	L	--	--	--	--	--	L	--	--	--	H	M	--

L-Low, M-Moderate(Medium), H-High

18CPE$07	BRIDGE ENGINEERING

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC502 Structural Analysis I
2 18CPC503 Basic Structural Design II (Concrete)

COURSE OBJECTIVES:

* To familiarize with types and choice of bridges.
* To understand the design concepts of bridge structures and culverts.
* To obtain the knowledge of bearings and sub structures.

UNIT – I : INTRODUCTION (9 Periods)

Components of a bridge structure – inspection and site investigations for a bridge – Determination of linear waterway, design discharge and scour depth – Economical span – Types and choice of bridges. IRC loading classifications – simple problems.

UNIT – II : SLAB BRIDGE AND T- BEAM BRIDGES (9 Periods)

Slab Bridge - Distribution of concentrated loads by IRC and Pigeaud's Method – Design of T- beam bridge – design of main girder– Design of cross girders – Load distribution by Courbon's Method – Skew slab Bridge.

UNIT – III : BRIDGE AND BOX CULVERT (9 Periods)

Single span rigid frame bridge (barrel or slab type only) – box culvert (single vent only). Balanced cantilever RC bridges– Design of articulations.

UNIT – IV : MODERN BRIDGES (9 Periods)

Temporary and movable bridges. RC Arch bridge (open spandrel and string girder type only) – Cable stayed bridges –Suspension bridges – design principles only.

UNIT – V : SUBSTRUCTURE, BEARING, AINTENANCE AND INSPECTION OF BRIDGES (9 Periods)

Bearings – types, functions – simple problems – substructures – abutment, pier – materials-stability requirements -Rebuilding of bridges – replacement – pier tops – girders – side sleeving and end launching methods – Joints in bridges. Case studies.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Jhonson Victor .D., **"Bridge Engineering"**, Oxford & IBH publishing Co., Ltd, New Delhi, 2003.*
2 *Jagadeesh T.R.andJeyaram M.R., **"Design of Bridge Structures"**, Prentice Hall of India, 2011.*
3 *NPTEL notes - https://nptel.ac.in/courses/105105165.*

REFERENCE BOOKS:

1 *Vazirani V.N., Ratwani M.M., & Vaswani, **"Bridge Engineering"**, Khanna publishers, 2000.*
2 *Bindra S.P., **"Principles and practice of Bridge Engineering"**, Dhanpat Rai & Sons, New Delhi,1995.*
3 *KrishnarajuN., **"Design of bridges"**, New age international publishing ltd, NewDelhi, 2005.*
4 *Ponnuswamy.S, **"Bridge Engineering"**, 3rd edition, Tata McGraw Hill Publishing Co., Ltd, New Delhi, 2017.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Describe components and types of bridges and understand economical span.
CO2: Design of slab bridge by Pigeaud's method load distribution.
CO3: Apply the principles in the design of rigid frame and balanced cantilever bridges.
CO4: Apply the principles in the design of modern bridges.
CO5: Design the sub structures.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	H	M										L		
CO2	H	M	H	M					H						H	
CO3	H	M	H	L										L		
CO4	H	M	H	L												L
CO5	H	M	H	M					M						M	
18CPE $07	H	M	H	M					H					L	H	L

L-Low, M-Moderate (Medium), H-High

18CPE$08	EARTHQUAKE ENGINEERING

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES302 Engineering Mechanics for Civil Engineers
2 18CPC303 Strength of Materials
3 18CPC503 Basic Structural Design II (Concrete)
4 18CPC502 Structural Analysis I

COURSE OBJECTIVES:

* To learn the causes and effects of earthquake and its measurement.
* To understand the concepts of seismic resistant design of structures.
* To enhance the ability to design earthquake resistant structures by using IS codal provisions.
* To know about the modern techniques of earthquake resistant structures.

UNIT – I : SEISMOLOGY (9 Periods)

Elements of engineering seismology – Structure of earth, causes of earthquakes, plate tectonic theory, continental drift theory, elastic rebound theory, seismic waves, magnitude, intensity and energy release – Indian seismology –Earthquake history – Seismic zone Map of India – seismographs – seismogram – accelerograph – prominent earthquakes in India.

UNIT – II : SEISMIC DESIGN CONCEPTS (9 Periods)

Concept of earthquake resistant design –strong column weak beam concept – guide lines for seismic resistant construction – effects of structural irregularities – seismo resistant building architecture, Response and design spectra, Design earthquake – concept of peak acceleration – Site specific response spectrum, Planning Aspects, Liquefaction of soils, Methods of introducing ductility into RC structures.

UNIT – III : DESIGN METHODOLOGY (9 Periods)

Introduction to methods of seismic analysis – Equivalent static analysis IS 1893 provisions – Design horizontal seismic coefficient – design base shear – distribution – idealization of building frames - seismic analysis and modeling – determination of lateral forces – equivalent static lateral force method – response spectrum method.

UNIT – IV : ASEISMIC CODAL PROVISIONS (9 Periods)

Behaviour of unreinforced masonry and reinforced masonry, RC bands, Vertical reinforcement, Openings, Provisions of IS 4326, Repairs and strengthening of masonry and RC members. Ductile detailing of reinforcement in RC Buildings as per IS 13920.

UNIT – V : MODERN TECHNIQUES (9 Periods)

Introduction to Earthquake resistant modern techniques - Base isolation techniques – Elastometric, Sliding, Combined - Seismic Dampers, Friction Dampers, Visco elastic dampers. Vibration control measures – Important points in mitigating effects of earthquakes on structures.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Chopra, A.K., **"Dynamics of structures – Theory and Applications to Earthquake Engineering, Second Edition"**, Pearson Education, 2015.*
2 *Pankaj Agarwal & Manish Shrikhande, **"Earthquake Resistant Design of Structures"**, Prentice Hall of India, NewDelhi, 2009.*
3 *S.K.Duggal, **"Earth Quake Resistant Design of Structures"**, Oxford university Press, 2013.*
4 *Damodarasamy S R and Kavitha S, **"Basics of Structural Dynamics and Aseismic Design"**, Prentice Hall India Publishers, 2009*

REFERENCE BOOKS:

1 *Bruce A Bolt, **"Earthquakes"**, W H Freeman and Company, New York, 2004.*
2 *C. A. Brebbia, **"Earthquake Resistant Engineering Structures VIII"**,WIT Press, 2011*
3 *Indian Standard Codes: IS: 1893:2016 (part 1 to 5), IS: 4326 :2013, IS 13828:1993(R2008) and IS:13920:2016, Bureau of Indian Standards, New Delhi.*

COURSE OUTCOMES:

On the Completion of the course, the students will be able to

CO1: Analyse the causes and effects of earthquake.
CO2: Familiarize the design concepts for earthquake resistant structures.
CO3: Plan the structures to resist earthquake forces.
CO4: Apply Indian codal provisions in the planning, design and detailing of structures.
CO5: Execute vibration control techniques modern techniques in various structures.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H					H	M	L	L	L	L	L	L		L	M
CO2	H	H	H	L		M	L	L	L		L		L	H	H	
CO3	H	L	H			M			L					H	H	
CO4	H	L	L	L	H	L	L		L				M	M	M	M
CO5	H	M	H	H	H	H			M	L	M	L	H	L	M	M
18CPE $08	H	H	H	L	H	H	L	L	L	L	L	M	M	H	H	M

L-Low, M-Moderate (Medium), H-High

18CPE$09	SAFETY IN CIVIL ENGINEERING PRACTICES

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES403 Construction Materials and Technology

COURSE OBJECTIVES:

* To impart the basic knowledge about safety requirement at every stage of construction work.
* To follow the basic protective measures and safety aspects during construction
* To acquire knowledge on equipments needed for safety during construction.

UNIT – I : PRE-CONSTRUCTION (9 Periods)

Planning and scheduling – Housekeeping – Safe access – Site safety – Basic checklist – Electrical Safety – Electrical power lines –Temporary Wiring – Overhead high-voltage and low-voltage electricity – Underground electrical hazards.

UNIT – II : CONSTRUCTION (9 Periods)

Personal Safety – Basic personal protective equipment and clothing – Eye and Face protection, Foot protection, Hand protection, Head protection and Hearing protection – Safety related work practices – Safety measures during Excavation – General requirements for trenches and excavations, Sloping and shoring requirements, Underground construction.

UNIT – III : FORMWORK AND POURING (9 Periods)

Safety measures for Formwork – Slip forms – Working platforms – Materials Hoist – Concrete pouring and pumping – General framing – Guardrails – Floor and roof openings – Lifting appliances – Fall protection.

UNIT – IV : TRUSS AND ROOF WORK (9 Periods)

Trusses – Instruction for truss installers, Truss erection – Roof work – Roof jacks and toe-holds (slide guards) Scaffolds – General provision – Guardrails, Toe boards for scaffolds – Erection requirements – Wood scaffolds erection guidelines – Other types of scaffolds, Ladder-jack scaffolds Trestle scaffolds, Shore and lean-to scaffolds, Suspended scaffolds, Rolling scaffolds.

UNIT – V : EQUIPMENT SAFETY (9 Periods)

Ladders Safety – General requirements – Job-built ladders, Stepladders – Portable tools – Hand tools, Pneumatic tools, Power tools-saws – Compressed air for cleaning – Pneumatic nailing and stapling equipment, Construction site hazards.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Allen St.John Hot, **"Principles of Construction Safety"**, John Wiley & Sons, 2005.*
2 *Mark Mc.Guire Moran, **"Construction Safety Hand Book"**, 2003.*
3 *David L.Geotsch, **"Construction Safety and Health"**, 2003.*

REFERENCE BOOKS:

1 *Grimaldi Simonds **"Safety Management"**, AITBS Publishers, 2001.*
2 *Tim Howarth, Paul Watson, **"Construction Safety Management"**, 2008.*
3 *John Schaufelberger **"Construction Project Safety"**, Wiley Publications, 2013.*

COURSE OUTCOMES:

On completion of this course, the students will be able to
CO1: Adopt the safety measures during pre-construction work.
CO2: Follow the basic protective measures during construction.
CO3: Assess safety measure during concreting work.
CO4: Choose protective measures during truss and roof construction.
CO5: Select equipments needed for safety during construction.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H					H	M	L	L	L	L	L	L		L	M
CO2	H	H	H	L		M	L	L	L		L		L	H	H	
CO3	H	L	H			M			L					H	H	
CO4	H	L	L	L	H	L	L		L				M	M	M	M
CO5	H	M	H	H	H	H			M	L	M	L	H	L	M	M
18CPE $08	H	H	H	L	H	H	L	L	L	L	L	M	M	H	H	M

L-Low, M-Moderate (Medium), H-High

18CPE$10	VALUATION

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES403 – Construction Materials and Technology
2 18CEE508 - Computer Aided Civil Engineering Drawing

COURSE OBJECTIVES:

* To understand the fundamentals and the various concepts of valuation
* To determine the depreciation of any property
* To know the methods of valuation for Fields, open lands and building

UNIT – I : COST, PRICE AND VALUE (9 Periods)

General - Real properties and personal properties - Differences between the real properties and personal properties - Valuation - Cost, price and value - Concept of the term value - Purposes of valuation - Different forms of value - Factors affecting changes in market value - Classification of the valuers - Role of the valuer - New horizons of valuation.

UNIT – II : MORTGAGE, FREEHOLD AND LEASEHOLD PROPERTIES (9 Periods)

General - Types of interests - Freehold interests - Leasehold interests - Difference between freehold and leasehold property - Mortgage - Reverse mortgage - Typical problems.
Outgoings and Net income - Definition - Usual types of outgoings - Typical problems - Gross income and net income.

UNIT – III : DEPRECIATION (9 Periods)

Meaning of the term - Depreciation as cost in operation - Depreciation as decrease in worth - Physical conditions - Functional obsolescence - Economic obsolescence - Difference between depreciation and obsolescence - Methods for estimating cost depreciation - Cost of construction - Cost depreciation and value depreciation - Reproduction cost and replacement cost - Depreciation and depletion - Typical problems.

UNIT – IV : VALUATION FOR AGRICULTURAL LANDS & RENT (9 Periods)

Importance - Crop loans - Investment loans - Development loans - Factors affecting value of agricultural land - Cottages and buildings - Size of farm - Fencing and gates - Title of land - General situation - Types of crops - Quality of soil - Water supply and electricity - Roads and approaches - Methods of valuation of agricultural lands - Income capitalisation method - Sales statistics method - Cottages and buildings - Valuation date - Field-to-field valuation - Agricultural land and direct tax laws. STANDARD RENT - Forms of rent - Objects of Rent Act - Meaning of standard rent - Exemptions from the Rent Act - Process of fixing standard rent - Methods of ascertaining standard rent - Important factors - Inheritance of tenancy right - Typical problems.

UNIT – V : METHODS OF VALUATION (9 Periods)

General - Methods of valuation for open lands - Methods of valuation for lands with buildings - Rental method - Direct comparisons of the capital value - Valuation by reference to profits - Valuation based on the cost or contractor's method - Residual or development method - Typical problems - Valuation of Licensed Premises - General principle of valuation - Valuation of a cinema - Valuation of a hotel - Typical problems.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *B. N. Dutta, **"Estimating and Costing in Civil Engineering"**, UBS Publishers Distributors Ltd. 2016*
2 *S. C. Rangwala, Estimatin, **"Costing and valuation"**, Charotar Publishing House, 2009.*
3 *G. S. Biridi, **"Textbook of Estimating & Costing"**, Dhanapat Rai & Sons. Delhi, 2016.*
4 *M.Chakraborti, **"Estimating Costing Specification And Valuation In Civil Engineering"** Chakraborti 2006.*
5 *P.W.D. Hand Book.*

REFERENCE BOOKS:

1 *Patil, B.S., **"Civil Engineering Contracts, Vol. – I"**, Orient Longman Publication, 1998.*
2 *Rangwala, S.C., **"Elements of Estimating and Costing"**, Professional practice, Charotar Publishing House, Anand. 2009*
3 *Aggarwal, A., Upadhyay, A.K., **"Civil Estimating, Costing & Valuation"**, S.K Kataria& Sons, New Delhi, 2013*
4 *Chandola, S.P. and Vazirani, **"Estimating and Costing"**, Khanna Publication, 2001.*

COURSE OUTCOMES:

On Completion of the course, the students will be able to

CO1: Explain principle of valuation and cost.
CO2: Calculate outgoings and net income.
CO3: Assess the depreciation of any property.
CO4: Determine the valuation of agriculture land.
CO5: Evaluate the actual value of any property.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M				M									M	M	
CO2	H	M			M									L		
CO3	M				L			M						M	M	
CO4	M	M			M									L		
CO5	H	M			M									M	M	
18CPE $10	M	M			M			M						M	M	

L-Low, M-Moderate (Medium), H-High

18CPE$11	DESIGN AND DRAWING (IRRIGATION AND ENVIRONMENTAL ENGINEERING)

Category : PE

L	T	P	C
2	0	2	3

PRE-REQUISITES:

1 18CPC306 Water Supply Engineering
2 18CPC406 Waste Water Engineering

COURSE OBJECTIVES:

* To understand the various irrigation structures and unit processes of a water and wastewater treatment plants.
* To gain knowledge on different Irrigation Engineering and Environmental Engineering structures.
* To train the students in preparation of drawings for Irrigation and Environmental Structures and its necessity for the implementation work.

PART A : IRRIGATION ENGINEERING (30 Periods)

Tank Surplus Weir (Type A and D) - Tank Sluice with a Tower Head - Direct Sluice - Notch type Canal Drop - Canal Regulators and river regulators - Cross-Drainage Works (Syphon Aqueduct type II & III)

PART B : ENVIRONMENTAL ENGINEERING (30 Periods)

Intake tower - Screening device - Primary sedimentation tank – Clariflocculator - Slow and Rapid sand filters - Secondary settling tanks - Trickling filter - Activated sludge process - Sludge digestion tank - Septic tank with dispersion trench and soak pit - Infiltration gallery.

Note: Assignments include the design and drawings of various Irrigation and Environmental Engineering Structures.

QUESTION PAPER PATTERN:

Question paper shall consist of two questions from each part. Part A consists of 60 marks and Part B consists of 40 marks and the students have to answer one question from each part.

Contact Periods: Lecture: 30 Tutorial: 00 Practical: 30 Total : 60 Periods

TEXT BOOKS:

1 *Sathya Narayana Murthy Challa, **"Water Resources Engineering Principles and Practice"**, New Age International (P) Ltd., New Delhi, 2009.*
2 *Rangwala.S.C, **"Water Supply and Sanitary Engineering"**, Charotar Publishing, New Delhi, 2016.*

REFERENCE BOOKS:

1 *Santosh Kumar Garg,* ***"Irrigation Engineering and Hydraulics Structures"****, Khanna Publications Pvt. Ltd, New Delhi, 2017.*

2 *Birde.G.S and Birde.J.S,* ***"Water Supply and Sanitary Engineering"****, Dhanpat Rai Publications Pvt. Ltd, New Delhi, 2018.*

COURSE OUTCOMES:

On Completion of the course, the students will be able to:

CO1: Design the different Hydraulic structures in the field.
CO2: Prepare drawings for Irrigation Structures.
CO3: Know the functions of different Environmental Engineering structures in the field.
CO4: Design and detailing of the Environmental Structures.
CO5: Evaluate the performance of Irrigation and Environmental Structures in real life.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		M	M		L	L			H	L		L	H	M	L
CO2	H	L	L	L			M	L		M				M	L	
CO3	H		M	M		L	L			H	L		L	H	M	L
CO4	H	L	L	L			M	L		M				M	L	
CO5	L		M	M		L	L			H	L		L	H	M	L
18CPE $11	H	L	M	M		L	M	L		H	L		L	H	M	L

L-Low, M-Moderate (Medium), H-High

18CPE$12	ENVIRONMENTAL LEGISLATIONS IN INDIA

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC306 Water Supply Engineering
2 18CPC406 Waste Water Engineering

COURSE OBJECTIVES:

* To impart knowledge of National and international Environmental Policies.
* To know the pollution control acts for water and air pollution
* To understand the management and handling of Industrial solid waste and E- waste.

UNIT – I : THE WATER (PREVENTION & CONTROL OF POLLUTION) ACT, 1974 (9 Periods)

Definitions-Salient features-Powers & functions of Regulatory agencies–Responsibilities of occupier, provisions relating to prevention & control-procedures to obtain consent-Monitoring and compliance mechanisms-legal provision for violation of Water(P&CP)Act-Case studies on water polluting industries-Textile dyeing, Paper mills-Electroplating, Starch industries-inventorisation of new water polluting industry and its management-field visits.

UNIT – II : THE AIR (PREVENTION & CONTROL OF POLLUTION) ACT, 1981 (9 Periods)

Definition-Salient features- Powers & functions of Regulatory agencies -National ambient Air quality standards-Emission standards for industries specific- Responsibilities of occupier, provisions relating to prevention & control-procedures to obtain consent Monitoring and compliance mechanisms- legal provision for violation of Air(P&CP)Act- Case studies on Air polluting industries-Foundries, Cement, Thermal power plants- inventorisation of new Air polluting industry and its management-field visits.

UNIT – III : THE ENVIRONMENT (PROTECTION) ACT, 1986 (9 Periods)

Genesis of the Act-Salient features-Role of Central Government-various notifications and rules – prohibition on import of genetically modified organisms-chemicals-hazardous wastes- Batteries management-Restriction on Ozone depleting substances-EIA notification-Sitting of industries-State level EIA Authorities-eco-mark-Control on noise pollution-coastal regulations- Monitoring and compliance mechanisms-Role of National Green Tribunals(NGT),Environmental courts & Public interest litigation -Case studies

UNIT – IV : REGULATIONS ON INDUSTRIAL SOLID WASTE MANAGEMENT (9 Periods)

Restriction on Hazardous waste-Bio-medical wastes-Recycled plastic wastes-Municipal solid wastes-e-waste-Salient features-Responsibilities of occupier/generator/local bodies/PCBs- Monitoring and compliance mechanisms-consent clearance, Authorization, Registration procedures for industry specific-Issues & Challenges-Best practices-Case studies on lead refining, engineering units, hospitals, plastic units, Municipal landfills -field visits.

UNIT – V : ELECTRONIC WASTE (MANAGEMENT AND HANDLING) RULES 2011 **(9 Periods)**

Definition-Environmental & Occupational Health hazards of e-waste-Salient features of E-waste Rules-Extended producers responsibility-issues and challenges –Compliance and Consent Clearance mechanisms-Best practices of E-waste management-Case studies on E-waste recycling units, Bulk consumers, Collection Centers-field visits.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *P.Leelakrishnan., **"Environmental Law in India"**, Lexis Nexis 4th edition 2016.*
2 *Stuart Bell and Donald., **"Environmental Law"**, McGillinary sixth edition 2005.*
3 *Shyam Divan and Armin Roseneranz, **"Environmental law and policy in India"**, Oxford University Press, New Delhi, 2017.*
4 *K.R.Gupta. **"Environmental legislation in India"**, Atlantic 2006.*
5 *E WASTE MANAGEMENT IN INDIA (2009), Electronics for you**,** www. efymag.com.*

REFERENCE BOOKS:

1 *Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, **"Integrated Solid Waste Management",** McGraw- Hill, New York, 1993*
2 *CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000*
3 *Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans, **"Environmental Resources Management, Hazardous waste Management"**, Mc-Graw Hill International edition, New York, 2001.*
4 *Vesilind P.A., Worrell W and Reinhart, **" Solid waste Engineering"**, Thomson Learning Inc., Singapore, 2002.*
5 *David ong., **"Source book on environmental Law"**, 2001*
6 *www.envfor.nic.in*

COURSE OUTCOMES:

On Completion of the course, the students will be able to:

CO1: Apply various act related to Environmental issues.
CO2: Plan and take decisions related to Environmental policies.
CO3: Summarize the pollution control acts for water and air pollution
CO4: Perform management and handling of Industrial solid waste and E- waste
CO5: Choose the management and handling of E- waste

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1							M				L	L		L	L	
CO2	H	L	M			L	H	L				L	L	M		
CO3		L				M	H	M			L	L		L	L	
CO4	M	H		M			M	L		L	M	L	M	L		L
CO5		M	L	H		L	L	L		L		L		M		
18CPE $12	H	M	L	M		L	H	L		L	L	L	L	L	L	L

L-Low, M-Moderate (Medium), H-High

18CPE$13	INDUSTRIAL WASTEWATER MANAGEMENT

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC306 – Water supply engineering
2 18CPC406 – Waste water engineering

COURSE OBJECTIVES:

* To understand the Qualitative and quantitative assessment of industrial wastewater
* To analyze the effect of disposal of industrial wastewater
* To understand the principles of waste minimization technique on environment
* To gain Knowledge about Pollution from major industries and treatment Technologies

UNIT – I : SOURCES (9 Periods)

Sources and types of industrial wastewater – Environmental impacts – Regulatory requirements – Industrial wastewater monitoring and sampling – generation rates – characterization and variables – Toxicity and Bioassay tests. Prevention vs Control of Industrial Pollution – Source reduction techniques - effect of Industrial Effluents on Streams, Sewer and Human health – Waste Audit Evaluation of pollution prevention options. Industrial scenario in India – Industrial activity and environment – Uses of water by Industry

UNIT – II : TREATMENT (9 Periods)

Waste minimization - Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal removal – Adsorption – Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – Photocatalysis – Wet Air Oxidation - Evaporation – Ion Exchange – Membrane Technologies – management of RO reject - Nutrient removal – Cost benefit analysis – payback period - Implementing and promoting pollution prevention programs in industries.

UNIT – III : DISPOSAL (9 Periods)

Individual and Common Effluent Treatment Plants – Advantages – Joint treatment of Industrial and domestic wastewater - zero polluting industry concept –Reduce, Reuse and Recycle of wastewater – Disposal of effluent on land – Quantification, characteristics and disposal of sludge

UNIT – IV : INDUSTRIAL WASTEWATER TREATMENT-I (9 Periods)

Industrial manufacturing process description, wastewater characteristics, source reduction points and effluent treatment flow sheet for Textiles - Sugar mill – distilleries - Thermal power plant - Nuclear power plant - Petroleum refineries - Fertilizers – Dairy - Pharmaceutical industry

UNIT – V : INDUSTRIAL WASTEWATER TREATMENT-II (9 Periods)

Industrial manufacturing process description, wastewater characteristics, source reduction points and effluent treatment flow sheet for , Pulp and Paper mill - Chemical industries - Metal finishing industries - Iron and Steel industries - Meat packing industries and Poultry plant - Automobile Industry- Industrial estates and Industrial Clusters.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Garg S.K., **"Sewage Disposal and Air Pollution Engineering"**, Khanna Publishers, New Delhi, 2018*
2 *Patwardhan, A.D., **"Industrial Waste Water Treatment"**, PHI Learning, 2009*
3 *Metcalf and Eddy, **"Waste Water Engineering- Treatment and Reuse"**, Tata Mc-Graw Hill Company, New Delhi 2007*
4 *Duggal. K.N., **"Elements of public Health Engineering"**, S.Chand and Co, 2007.*
5 *M.N.Rao, A.K.Datta, **"Wastewater treatment"**, McGraw Hill, 2017.*

REFERENCE BOOKS:

1 *Eckenfelder, W.W., **"Industrial Water Pollution Control"**, McGraw-Hill, 2014.*
2 *Soli. J Arceivala, Shyam. R Asolekar **"Wastewater Treatment for Pollution Control and Reuse"**, McGraw-Hill, 2006.*
3 *Frank Woodard, **"Industrial waste treatment Handbook"**, Butterworth Heinemann, New Delhi, 2006.*
4 *Nemerow N. L., **"Industrial Water Pollution"**, Addison - Wesley Publishing Company Inc., USA, 2007.*
5 *Mahajan S. P. **"Pollution Control in process industries"**, Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008.*
6 *NPTEL, **"Industrial waste water treatment"**, Prof BS Murty., IIT Madras.*

COURSE OUTCOME:

On Completion of the course, the students will be able to

CO1: Carry out qualitative and quantitative assessment of industrial wastewater
CO2: Apply the principles of waste minimization techniques
CO3: Identify and select appropriate disposal methods
CO4: Manage the effluent treatment from major industries
CO5: Apply the concept of industrial clusters

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H			L			L							H		L
CO2	H			L		L	M					L		H	M	L
CO3	H			L		L	M					L		H	M	L
CO4	H	L	M	M		L	M							H	M	L
CO5	H	L		M			L									L
18CPE $13	H	L	M	L		L	M					L		H	M	L

L-Low, M-Moderate (Medium), H-High

18CPE$14	SUSTAINABLE ENGINEERING AND TECHNOLOGY

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To understand the role of engineering and technology within sustainable development
* To know the methods, tools, and incentives for sustainable product-service system development
* To establish a clear understanding of the role and impact of various aspects of engineering and engineering decisions on environmental, societal, and economic problems.

UNIT – I : INTRODUCTION TO SUSTAINABILITY (9 Periods)

Sustainability - Introduction, Need and concept of sustainability, Social environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM)

UNIT – II : GLOBAL ENVIRONMENTAL ISSUES (9 Periods)

Air Pollution, Effects of Air Pollution; Water pollution- sources, Sustainable wastewater treatment, Solid waste - sources, impacts of solid waste, Zero waste concept, 3 R concept. Global environmental issues- Resource degradation, Climate change, Global warming, Ozone layer depletion, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print.

UNIT – III : LIFE CYCLE ANALYSIS AND ENVIRONMENT IMPACT ASSESSMENT (9 Periods)

Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking, Environment Impact Assessment (EIA) - Procedures of EIA in India. Environmental legislations in India - Water Act, Air Act.

UNIT – IV : SUSTAINABLE HABITAT (9 Periods)

Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainable cities, Sustainable transport.

UNIT – V : SUSTAINABLE ENERGY SOURCES (9 Periods)

Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total: 45 Periods

TEXT BOOKS:

1 *Allen, D. T. and Shonnard, D. R.,* ***"Sustainability Engineering: Concepts, Design and Case Studies"****, Prentice Hall, 2011.*

2 *Twidell, J. W. and Weir, A. D.,****"Renewable Energy Resources"****, Taylor & Francis Ltd, 2015.*

3 *Bradley. A.S; Adebayo,A.O., Maria, P.****"Engineering applications in sustainable design and development"****, Cengage learning, 2015.*

REFERENCE BOOKS:

1 *ECBC Code 2007,* ***"Bureau of Energy Efficiency"****, New Delhi Bureau of Energy Efficiency Publications*

2 *Ni bin Chang,* ***"Systems Analysis for Sustainable Engineering: Theory and Applications"****, McGraw-Hill Professional, 2010.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Explain the need for sustainable development
CO2: Identify different types of environmental pollution problems and their sustainable solutions
CO3: Perform Life Cycle Analysis and Environment Impact Assessment
CO4: Apply the concepts of sustainable habitat while designing an infrastructure
CO5: List and explain sustainable energy sources

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H			M		H	H					M		M		L
CO2	H		H	M		H	H							M	H	L
CO3	H		M	H	M	H	H					L		M	H	L
CO4	H			M		H	H							M		L
CO5	H					H	H							M		
18CPE $14	H		H	M	M	H	H					M		M	H	L

L-Low, M-Moderate (Medium), H-High

18CPE$15	GROUND IMPROVEMENT TECHNIQUES

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC504 Mechanics of Soils

COURSE OBJECTIVES:

* To understand the various dewatering techniques
* To know the in-situ treatment of cohesionless and cohesive soils
* To gain knowledge on the different stabilization methods
* To know the various types of grouts and grouting techniques

UNIT – I : DEWATERING (9 Periods)

Scope and necessity of ground improvement – Methods of ground improvement – Selection based on soil conditions – Dewatering by well point system – Deep well-Vacuum and Electro - Osmotic method.

UNIT – II : COMPACTION AND VERTICAL DRAINS (9 Periods)

In-situ densification of granular soils and consolidation of cohesive soils – Shallow and deep compaction – Vibration methods – Vibrocompaction, Blasting, Vibroflotation – Factors influencing compaction –Heavy Tamping – Vertical drains – Preloading with sand drains, Wick drains –Relative merits and limitations of different methods.

UNIT – III : STONE COLUMN AND CONSOLIDATION (9 Periods)

Stone columns and lime piles – Construction methods – merits and demerits – Precompression and consolidation – simple design-Dynamic consolidation – Electro-osmotic consolidation -Earth reinforcement – types and applications of Geosynthetics – filtration – drainage – separation – reinforcement – Soil Nailing.

UNIT – IV : SOIL STABILIZATION (9 Periods)

Stabilization methods – Mechanical, Chemical stabilisation-Cement, Lime, Bitumen – Electro - kinetic stabilization – Stabilization of expansive clays.

UNIT – V : GROUTING (9 Periods)

Types of grouts – Suspension and solution grouts –Basic requirements – Displacement grouting – Compaction grouting – Permeation grouting –Cement grouting-Lime grouting-Grouting equipment and methods – Grout monitoring schemes.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Purushothama Raj, P., **"Ground Improvement Techniques"**, Laxmi Publications (P) Ltd., New Delhi, 2005.*
2 *Nihar Ranjan Patra., **"Ground Improvement Techniques"**, Vikas publishing House Pvt. Ltd., 2012.*

REFERENCE BOOKS:

1 *Day,R.W., **"Foundation Engineering Handbook"**, Mc-Graw Hill Companies, Inc. 2006.*
2 *Rowe, R.K., **"Geotechnical and Geoenvironmental Engineering Handbook"**, Kluwer Academic Publishers, 2001.*
3 *Peter G. Nicholson, **"Soil Improvement and Ground Modification Methods"**, Butterworth Heinemann, 2015.*
4 *Klaus Kirsch and Alan Bell, **"Ground Improvement, Third Edition"**, CRC Press, Taylor and Francis Group, 2013.*

COURSE OUTCOMES:

On completion of the course, the students will be able to
CO1: Select suitable ground improvement techniques and different dewatering techniques
CO2: Acquire knowledge on various in-situ treatment of cohesionless and cohesive soils.
CO3: Implement the constructional aspects of stone column and earth reinforcement.
CO4: Identify and implement suitable stabilization methods.
CO5: Select and apply different grouting techniques.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		L			M								H	H	
CO2	H		L											H		
CO3	H	M	M			M								H	H	
CO4	H											L		H		
CO5	H											L		H	H	
18CPE $15	H	M	L			M						L		H	H	

L-Low, M-Moderate (Medium), H-High

18CPE$16	PAVEMENT ENGINEERING

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC504 Mechanics of soils

COURSE OBJECTIVES:

* To gain knowledge on various IRC guidelines for designing flexible and rigid pavements.
* To assess the quality and serviceability conditions of roads.
* To learn about the evaluation of pavements and strengthening methods

UNIT – I : BASIC CONCEPTS (9 Periods)

Pavement – Types and components – Comparison – Function of components – Factors affecting design and performance of pavements – Vehicle and traffic factors – Design wheel load – Maximum wheel load –contact pressure – ESWL – Repetition of loads – Stresses and deflections in homogeneous masses.

UNIT – II : FLEXIBLE PAVEMENT (9 Periods)

Various approaches of design – Empirical, Semi-empirical and theoretical methods – IRC design guidelines – Applications of different pavement design methods

UNIT – III : RIGID PAVEMENT (9 Periods)

Stresses in rigid pavement – Evaluation –IRC design guidelines– Types of joints and their functions– Design of joints.

UNIT – IV : QUALITY CONTROL (9 Periods)

Field compaction – Rammers – Rollers – Compaction control – insitu density –pavement materials - Bitumen – Ductility– Viscosity – Binder content and Softening point tests – Aggregate – Crushing – Abrasion – Impact Tests – Water absorption – Flakiness and Elongation indices.

UNIT – V : EVALUATION AND REHABILITATION (9 Periods)

Distress in flexible and rigid pavements – Pavement evaluation – Present Serviceability Index – Structural evaluation – Evaluation by deflection measurements – Strengthening of pavements – Flexible and rigid overlays.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *S.K.Khanna, C.E.G.Justo and Dr.A.Veeraraghavan, **"Highway Engineering"**, Khanna Publishers,Tenth Edition,2013*
2 *Yoder, E.J and Witchak, M.W, **"Principles of Pavement Design"**, e print, Newyork wiley, 2010.*
3 *Yang, **"Design of functional Pavements"**, McGraw Hill Publishing Company, 2004.*
4 *NPTEL-https://nptel.ac.in/courses/105105107/24*

REFERENCE BOOKS:

1 *Kadiyali, L.R and N.B.Lal., **"Transport planning & Traffic Engineering"**, Khanna Publishers, 2016.*
2 *S.K Sharma, **"Principles, Practice and Design of Highway Engineering"**, S. Chand & Co., Ltd., New Delhi, 2014.*
3 *Guidelines for the Design of Flexile Pavements, IRC: 37-2012, The Indian roads congress, New Delhi.*
4 *Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, IRC: 58-2015, The Indian Roads Congress, New Delhi.*
5 *IRC SP20-2002, Design and specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New-Delhi, Reprint 2013.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Gain knowledge on the types and components of pavements and calculate stresses in flexible pavement.
CO2: Use different methods for designing flexible pavements.
CO3: Calculate the stresses and design of rigid pavement using IRC guidelines
CO4: Execute various quality control tests on pavement materials.
CO5: Evaluate the strength of existing pavements and design the overlays.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H													H		
CO2	H	M		M								M		H	H	H
CO3	H	M		M								M		H	H	H
CO4	H		M	L		M								H		H
CO5	H		M	L		M								H	H	
18CPE $16	H	M	M	M		M						M		H	H	H

L-Low, M-Moderate (Medium), H-High

18CPE$17	AIRPORT, DOCKS AND HARBOUR ENGINEERING

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To expose the students to design principles of Airports.
* To know various components of a harbor, docks and their functions.
* To gain knowledge on break water construction methods and functions of navigational lights

UNIT – I : AIRPORTS SUB STRUCTURE CONSTRUCTION (9 Periods)

Air transport-development in India and importants in national transportation sector-airport planning and site selection for landing and terminal areas – layout of their components and locational requirements- airport classification- design standards of airports.

UNIT – II : AIRPORT COMPONENTS AND DRAINAGE (9 Periods)

Runways – Orientation – types, pattern layout- basic runway length-runway design – orientation, geometric design and corrections- Taxiways and apron - general principles of design, layout, construction and maintenance terminal area- terminal buildings, hangers and auxiliary structures. Airport drainage- various types, materials and construction features- airport marking and lighting.

UNIT – III : DOCKS AND HARBOUR (9 Periods)

Historical development of docks, harbours and seaports- Basic definition - Requirements and classification- recent trends in seaport planning and construction including container and special purpose terminals- inland water transport. Types of wet and dry docks- their functional design and usage

UNIT – IV : BREAK WATER AND QUAYS (9 Periods)

Types, uses and general construction methods of break water- layout and construction of quays and jetties and wharves.

UNIT – V : NAVIGATIONAL AIDS AND DREDGING (9 Periods)

Necessity and types of signals including floating signals – buoys and beacons- mooring and mooring accessories – Types of dredging and its application – Cargo handling.

Contact Periods: Lecture: 45 Tutorial: 00 Practical:00 Total : 45 Periods

TEXT BOOKS:

1 *Khanna.S.K and Arora.M.G., **"Airport planning and design"**, S.Chand and bros, 2006.*
2 *Vazirani.V.N and Chandola.S.P., **"Transportation and Engineering, Vol.2"**, Khanna publishers, New Delhi,2005.*

REFERENCE BOOKS:

1 *Shahani .P.B, **"Airport techniques"**, second edition- Oxford publishing, NewDelhi,1990.*
2 *Srinivasan.R., **"Harbour, Dock and Tunnel Engineering"**, Chartor publishing house, Anand, India,2004.*

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Prepare the airport layout by choosing appropriate site.
CO2: Design the run way with required facilities.
CO3: Identify various components of a docks, harbour and their functions.
CO4: Adopt suitable break water construction methods.
CO5: Choose suitable navigational aids and mooring accessories.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M				M		M		M		M	L	L		L
CO2	H	M	H		L	L			H		M			M	M	
CO3	M					M		M		M		M		L		L
CO4	M	M	L			L			M		M		L	L		
CO5	M		L			M		M			M	M				L
18CPE $17	M	M	L		L	M		M	H	M	M	M	L	L	M	L

L-Low, M- Moderate(Medium), H-High

18CPE$18	HIGHWAYS - STATE OF ART

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To impart an overview about the design and construction of various types of highways
* To gain knowledge about the procedures adopted in the Department of Tamil Nadu Highways.
* To get exposure on tendering and accounting procedures of Tamil Nadu Highways department.

UNIT – I : HIGHWAYS - BIRD'S EYE VIEW (9 Periods)

Highway Planning in India:
Classification and Authorities of roads in India – Function and duties of Ministry of Road Transport and Highways (MORT&H) and Indian Roads Congress (IRC) - Highways Research centers in India – Financing of Highways Infrastructures.

Tamilnadu Highways Department organizational setup and duties - Project Announcements - Financial Allotment - Government Orders - Issue of Letter of Credit.

Geometric elements of Highways:
Terrain, Land width, Building lines and Control lines, Right of Way, Carriage Way, Camber, Kerbs, Shoulders, Side slopes, Footpaths, Sight distances, horizontal and vertical alignments [IRC Standards] – Typical cross section - Components of bridge structures.

UNIT – II : DESIGN AND CONSTRUCTION OF HIGHWAY PAVEMENTS (9 Periods)

Desirable properties and quality assurance tests of materials for flexible and rigid pavements - Design of bituminous paving mixes - Design factors for flexible and rigid pavements - Design of flexible pavement using IRC:37-2012 – Design of bituminous overlay using IRC:81-1997 - Design of rigid pavements using IRC:58-2015.

UNIT – III : DESIGN AND CONSTRUCTION OF BRIDGES (9 Periods)

Engineering Surveys for Alignment of road bridges - Investigations for bridge works and preparation of field particulars - linear waterway calculation.
Classification of bridges – Basics of bridge design and drawings – Construction practices in Bridges - RMC site machineries and operations – Construction site machineries and operations - Quality Assurance activities at plant and construction sites.

Grade Separators and Elevated Structures:
Basics - Common types of Interchanges - Trumpet interchange, Diamond interchange, Cloverleaf interchange, Rotary interchange and Directional interchange - General features and Geometric Standards – Construction problems.

UNIT – IV : HIGHWAY MAINTENANCE (9 Periods)

Road maintenance:
Basic objectives – Classification of maintenance activities – Procedure for inspection and planning maintenance works – Surface and subsurface drainage of roads – Road markings and appurtenances.

Pavement failures:
Defects in Flexible pavements – Surface defects, Cracks, Deformation, Disintegration – Symptoms, Causes and Treatments; Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural cracks, Spalling of joints and Mud pumping - Treatments.

Hill roads:
Construction and maintenance - V shaped drains, Shadow and swamp areas, landslide - causes, investigation, preventive and remedial measures - protection of embankment and cut slopes – flood damage and emergency works – problems and remedial measures in hill road construction.
Applications of geosynthetics, reinforced earth and soil nailing in highways.

UNIT – V : TENDERING AND ACCOUNTING PROCEDURES (9 Periods)

Tendering:
Estimate preparation and sanctions – tendering and contracting procedures, laws of contracts – COT approval – agreements.

Accounting:
Recording measurements – bill preparation and processing – Working estimates – RAS – disputes and arbitration - Completion Certificates - Completion Report - Internal Audit and Accountant General Audit.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *T.F. Fwa, **"The Handbook of Highway Engineering"**, CRC Press, 2006.*
2 *Nicholas J. Garber, Lester A. Hoel, **"Traffic and Highways Engineering"**, Cengage Learning,2015*
3 *S.K.Khanna, C.E.G.Justo and Dr.A.Veeraraghavan, **"Highway Engineering"**, Khanna Publishers, Tenth Edition, 2013.*

REFERENCE BOOKS:

1 *Fred L. Mannering, Scott S. Washburn, **"Principles of Highway Engineering and Traffic analysis"**, John Wiley and Son, 2017.*
2 *E.J.Yoder and M.W.Witczak, **"Principles of Pavement Design"**, e- Print, Newyork Wiley,2010.*
3 *Kadiyali L R, **"Principles & Practice of Highway Engineering"**, Khanna Publishers, 2005.*
4 *IRC codes (IRC:37–2012, IRC-SP:19-2001, IRC-SP:90-2010, IRC:81-1997, IRC-SP:48-1998, IRC:58-2015, etc.,).*
5 *Specifications for Road and Bridge works, MORT&H (Fifth Revision)April 2013*

COURSE OUTCOMES:
On completion of the course, students will be able to
CO1: Categorize about different types of highways and geometric elements of highways.
CO2: Design and construct both flexible and rigid pavements based on IRC guidelines.
CO3: Apply the knowledge on engineering surveys for road bridges and construction procedures in bridge design.
CO4: Acquaint on different aspects of pavements and hill roads.
CO5: Prepare the tender documents as per the specifications of Tamil Nadu Highways department.

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COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M		M	L	H	H	L	L		L	M	H	H	M	L
CO2	H	H	H	M	M	H	H	L	M		H	M	H	H	H	L
CO3	H	M	H	H	M	H	M	L	M	M	H	M	H	H	H	L
CO4	H	M		M	H	H	H	L			L		H	M		L
CO5	H	M				M	M	M	L	M	M	M	H	M		M
18CPE $18	H	M	H	M	M	H	H	L	M	M	H	M	H	H	H	L

L-Low, M-Moderate(Medium), H-High

18CPE$19	TRAFFIC ENGINEERING AND MANAGEMENT

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To learn about Traffic elements, surveys, traffic regulation, management and traffic safety with integrated approach in traffic planning as well.
* To get familiarize in design principles of traffic signals, design of parking facilities, clover leaf intersection and traffic rotary.

UNIT – I : INTRODUCTION (9 Periods)

Scope– Properties of traffic engineering elements – vehicle, driver and road characteristics - skid resistance and breaking efficiency – simple problems. Components of traffic Engineering – control mechanisms.

UNIT – II : TRAFFIC SURVEYS (9 Periods)

Surveys – Classification - Volume, Speed and delay, origin and destination - parking, accidents – stastical methods for traffic engineering – simple problems – analysis-capacity of roads-level of service – interpretation of traffic studies and conclusions.

UNIT – III : TRAFFIC CONTROL (9 Periods)

Traffic signs – location and design recommendations - Road markings – Classification and design of traffic signals –signal co-ordination – Traffic islands and rotaries – Traffic control aids and street furniture – Regulation of traffic –Modern methods of traffic control.

UNIT – IV : TRAFFIC SAFETY AND MANAGEMENT (9 Periods)

Road accidents – types - causes and prevention with emphasis on engineering factor s – Traffic management, Transport system management (TSM) and Transport Demand Management (TDM), restrictions on turning movements, one way streets, traffic segregation, tidal flow operation, exclusive bus lanes and other management measures – introduction to intelligent transport systems (ITS).

UNIT – V : TRAFFIC MANAGEMENT PROJECTS (9 Periods)

Design of parking facilities, on street and off street parking – case studies on area traffic management – street lighting –noise and air pollution abatement – Basis of comprehensive traffic and transport studies – intersection improvements including design of roundabouts.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Kadiyali.L.R, **"Traffic Engineering and Transport planning"**, Khanna Publishers, 2011.*
2 *Salter.R.I., and Hounsell.N.B, **"Highway Traffic Analysis and Design"**, Macmillan Press Ltd., 2000.*

REFERENCE BOOKS:

1 *Manual of Transportation Engineering studies, Institution of Transportation Engineering, Prentice hall Publications, 1994.*
2 *Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning And Management*
3 *John.E.Tyworth., **"Traffic Management Planning"**, Operation and Control, Addison Wesley Publishing Company, 1997.*

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Express the detail about traffic elements and their characteristics
CO2: Conduct various traffic surveys
CO3: Perform design of traffic signals.
CO4: Analyse the causes of road accidents and take controlling measures.
CO5: Design of parking facilities with improved intersection points.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		L			L	L					L	H	L		
CO2	H	H		L	M	L			M	M	M	L		M	L	
CO3	H	M	H	L	L	L			L	H	L			M		
CO4	H	H	H	M	L	L			M	M		L		L	L	L
CO5	H	M	H	L	L	L			L	H	L	L		L	L	
18CPE $19	H	H	H	M	M				M	H	M	L		M	L	L

L-Low, M-Moderate(Medium), H-High

18CPE$20	FUNDAMENTALS OF REMOTE SENSING AND GIS APPLICATIONS

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC305 Surveying

COURSE OBJECTIVES:

* To introduce the students to the basic concepts and principles of various components of remote sensing.
* To provide an exposure to GIS and its practical applications in civil engineering.
* To acquire knowledge on the application of GIS in the areas of water resources, land use studies, soil science, Agriculture, forestry and Oceanography.

UNIT – I : PRINCIPLES OF REMOTE SENSING (9 Periods)

Definition – Historical background – Basic principles and methods of remote sensing – Electromagnetic radiation and source – Electromagnetic spectrum – Wave and particle theory – energy equations – Interference - Atmospheric effects on remote sensing – Atmospheric windows – Energy interaction with surface features – Reflectance – Specular and diffuse reflection surfaces – Spectral signatures – Spectral signature curves – Thermal and microwave.

UNIT – II : REMOTE SENSING DATA ACQUISITION (9 Periods)

Data acquisition – Active and passive remote sensing – Platforms – Aerial and space platforms – Aircraft and satellites– Synoptivity and Repetivity – Sensors – Aerial camera – Non-photographic optical sensors – Multispectral scanners –Thermal scanners, Imaging radars – SLAR and SAR LIDAR.

UNIT – III : SATELLITE REMOTE SENSING AND DIGITAL IMAGE PROCESSING (9 Periods)

Satellites – Classification – Based on orbits – Based on purpose – Remote sensing satellites – LANDSAT, SPOT, IRS and IKONOS – Their orbital characteristics – Sensors onboard – Characteristics of thermal imagery and radar imagery– Comparison with image types – Characteristics of digital image processing – Pre-processing – Image enhancement –Filtering – Classification.

UNIT – IV : GEOGRAPHIC INFORMATION SYSTEM (9 Periods)

GIS – Components of GIS – Hardware, Software and organizational set up – Data – Spatial and Non spatial – Maps –Types of maps – Map Projection – Types of projection – Data input – Digitization – Editing – Raster and Vector data structures – Comparison – Analysis using Rastor and Vector data – Retrieval, Reclassification, Overlying, Buffering –Data output – Printers and plotters.

UNIT – V : SATELLITE IMAGERY AND GIS APPLICATIONS (9 Periods)

Application of satellite imagery – Merits – Limitations – Comparison with aerial photographs – Visual interpretation of satellite imagery – Elements of interpretation – Interpretation keys-
GPS and its Applications- Application of remote sensing and GIS in Surveying, Water resources exploration – Land use/Land cover studies – Geology –Agriculture, Disaster Management, Coastal zone Management and Environmental Engineering.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *A M Chandra, S.K.Ghosh, **"Remote Sensing and Geographical Information system"**, Narosa, Publishing house New Delhi, 2006.*
2 *Patel A.N and Surendrasingh, **"Remote Sensing Principles and applications"**, Scientific Publishers, Jodhpur , 2001.*
3 *AnjiReddy, **"Remote Sensing and Geographical Information system"**, BS Publications 2014*
4 *M.G. Srinivas, (Edited by) **" Remote sensing applications"**, Narosa publishing House, 2001*

REFERENCE BOOKS:

1 *Thomas M.Lille sand & Raiph W.Kiefer, **"Remote sensing and Image Interpretation"**, John Wiley Sons,2004*
2 *Burrough P.A, Principles of GIS for land resources assessment, Oxford, 2002.*
3 *Fundamentals of Remote sensing, S.C.Bhatia, Atlantic Publishers & Distributions (P) Ltd, 2008.*

COURSE OUTCOMES:

On completion of the course, students will be able to:
CO1: Use the principles and methods of remote sensing.
CO2: Apply the concept of satellite remote sensing, Data acquisition.
CO3: Recognize LANDSAT, SPOT and IRS series, types and characteristics of imageries.
CO4: Categorize the hardware and software of GIS.
CO5: Utilize the application of GIS in the areas of water resources, land use studies, soil science, Agriculture, forestry and Oceanography.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H				L				M		H	M	L	H	L	M
CO2	H	H			M	L		H								
CO3	H				H					L				H		
CO4	H				H		H		M		H		M	H	M	M
CO5	H		M	M	H			M				H		H		
18CPE $20	H	H	M	M	H	L	H		M	L	H			H		M

L-Low, M-Moderate (Medium), H-High

18CPE$21	HIGHWAY AND RAILWAY ENGINEERING

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CPC305 Surveying

COURSE OBJECTIVES:

* To understand the basics of highway planning design and gain knowledge on design of road geometrics.
* To gain knowledge on components of pavement, understand the principles and design the flexible and rigid pavement using relevant IRC codes.
* To learn the properties and testing procedures of highway materials and understand the construction and maintenance on different types of roads.
* To understand the basics of railway planning and to gain knowledge on railway geometrics.
* To understand the functions of various components of railways, concepts of track maintenance, points and crossings and signals.

UNIT – I : HIGHWAY DEVELOPMENT, PLANNING AND GEOMETRICS (9 Periods)

Highway development and planning, Classification of Highways, Highway alignment, Highway Geometrics – Typical cross sections -Design of Cross sectional elements, Sight distance- Types- Horizontal and Vertical alignment- Design of curves – curve widening

UNIT – II : FLEXIBLE AND RIGID PAVEMENTS (9 Periods)

Components and their functions- Design principles of flexible and rigid pavements- Factors affecting the design of pavements- climate, subgrade, soil and traffic- Design of flexible pavements- Design of rigid pavements- Design of joints-IRC recommendations only

UNIT – III : HIGHWAY MATERIALS , CONSTRUCTION AND MAINTENANCE (9 Periods)

Properties and testing of Highway materials -Construction of roads – Earthen roads – W.B.M. roads – Bitumen roads –Cement concrete roads. Maintenance of all types of roads – Strengthening of pavements – Types of overlays

UNIT – IV : RAILWAY MATERIALS ,PLANNING AND DESIGN (9 Periods)

Location surveys and alignment - Conventional and Modern methods- Permanent way - Gauges - Components - Functions and requirements - Coning of Wheels -Geometric design- Gradients and Grade Compensation - Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves

UNIT – V : RAILWAY TRACK OPERATION AND MAINTENANCE (9 Periods)

Points and Crossings - Turnouts – Types - Working Principle Signalling, Interlocking and Track Circuiting - Construction and Maintenance – Conventional, Modern methods and Materials, Track Modernization– Automated maintenance and upgrading, Technologies, Re-laying of Track , Lay outs of Railway Stations and Yards.

Contact Periods: Lecture: 45 Tutorial: 00 Practical:00 Total : 45 Periods

TEXT BOOKS:

1 *S.K.Khanna, C.E.G.Justo and Dr.A.Veeraraghavan, **"Highway Engineering"**, Nemchand and Bros,Tenth Edition,2013.*

2 *Kadiyali, L.R. and N.B.Lal, **"Principles and practices of Highway Engineering"**, Khanna Publishers,2005.*

3 *Saxena S.C and Arora S.P., **"Railway Engineering"**, DhanapatRai Publications, 6th Edition, 2010*

4 *Satishchandra & MM Agarwal., **"Railway Engineering"**, Oxford University Press, Second Edition, 2013*

5 *NPTEL - https://nptel.ac.in/downloads/105101087*

REFERENCE BOOKS:

1 *Sharma S.K, **"Principles, Practice& Design of Highway Engineering"**, S.Chand and Co,2014.*

2 *Rangwala S.C & K.S. **"Railway Engineering"**, Charotar Publications, 14th Edition, 2008*

3 *K.P.Subramanian, **"Transportation Engineering: Highway Railway Airport & Harbour Engineering"**, Scitech publications (India) Pvt. Ltd, 2010.*

4 *Guidelines for the Design of Flexile Pavements, IRC: 37-2012, The Indian roads congress, New Delhi*

5 *Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, IRC: 58-2015, The Indian Roads Congress, New Delhi*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Illustrate the development, planning and geometric design standards for highways.

CO2: Execute the design of flexible and rigid pavements.

CO3: Comprehend the various desirable properties of highway materials, construction and maintenance of all types of roads

CO4: Outline the planning of railways and perform geometric design

CO5: Summarize the process of operation and maintenance of railway track.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H	L	L	M							H	M	H	M
CO2	L	L	H	H	M	M							L		H	M
CO3				M		H					L		H	L	H	L
CO4	M		H	L		M							H	M	H	M
CO5				M		H							H	L	H	L
18CPE $21	M		H	H		M	L				L		H	M	H	M

L-Low, M-Moderate(Medium), H-High

18CPE$22	IRRIGATION ENGINEERING AND HYDRAULIC STRUCTURES

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1. 18CPC603 Water Resources Engineering

COURSE OBJECTIVES:

* The student shall understand the need and mode of irrigation practiced in Tamil Nadu.
* To get an idea about the functions and design of different hydraulic structures.
* To select the appropriate type of canal regulation works for various hydraulic structures.

UNIT – I : IRRIGATION PRACTICE (9 Periods)

Necessity – Advantages and types of irrigation – methods of irrigation – Soil- water- plant relations - main crops and their seasons – saline, alkaline soils and their reclamation – root zone depth – Duty and Delta – relationship – Factors affecting duty – optimum utilization of water – Consumptive use of water by a crop – Estimation - assessment of irrigation water – Irrigation efficiencies – Problems.

UNIT – II : DIVERSION HEAD WORKS (9 Periods)

Functions of diversion head works – Types – Layout of diversion head works – Component parts – functions - Weir – types – Causes of failure of weirs and their remedies – Design of impervious floor by Creep theories – Bligh's theory - Khosla's theory – Design of a vertical drop weir – Design principles for under sluices.

UNIT – III : GRAVITY DAM (9 Periods)

Forces acting and their computation – Modes of failures - Elementary profile of a gravity of a dam – Practical profile - High and Low gravity dams — Stresses acting on dam - Design procedure for a gravity dam – Zoning method – Function of Gallery and Joints in gravity dam - Problems to check stability Analysis – Spillways – Main types of Spillway.

UNIT – IV : ARCH, BUTTRESS AND EARTH DAMS (9 Periods)

Types of Arch dams – forces acting on it – advantages - Buttress dams – types and uses of buttress dams. Earth dam - types of earth dams – Method of construction - Section of earth dams – Causes of failure of earth dams - criteria for safe design of earth dams – Cross sections of earth dam according to materials- seepage control measures in earth dam.

UNIT – V : CANAL REGULATION WORKS (9 Periods)

Canal falls – types – Design of vertical drop fall – Functions of Regulators - Design of head and cross regulators – Cross drainage works – types of cross drainage works – Selection of suitable types of cross drainage works – Classification of aqueducts and syphon aqueducts – Design procedure of cross drainage works.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Santosh Kumar Garg,* ***"Irrigation Engineering and Hydraulics Structures"****, Khanna Publications Pvt.Ltd. New Delhi, 2017.*
2 *Punmia .B.C. and Pande B.B.Lal,* ***"Irrigation and Water Power Engineering"****, Laxmi Publications, Pvt. Ltd, New Delhi, 2016.*

REFERENCE BOOKS:

1 *Sharma. R.K. and Sharma.T.K* ***"Irrigation Engineering and Hydraulics Structures"****, S.Chand& Company Pvt.Ltd, New Delhi, 2008.*
2 *Michel A.M.,* ***"Irrigation Engineering"****, Vikas Publishing House Pvt. Ltd, New Delhi, 2006*
3 *Madan Mohan Das and Mimi Das Saikia,* ***" Irrigation and water power Engineering"****, PHI Learning Ltd, Delhi, 2014.*

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1: Recognize the necessity and methods of irrigation system.
CO2: Identify the importance of diversion head works in water distribution system.
CO3: Check the forces acting and stability analysis of gravity dam.
CO4: Apply the design principles and importance of arch dam, buttress dam and earth dams.
CO5: Select the appropriate type of canal regulation structures in different situations.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L	L	L						M	M			M	L	H
CO2	L					L	L		M	M		L	L	H	L	M
CO3	L	H	M	H	L		M				L			M	L	M
CO4	M		L	H		L			L				L	H	M	L
CO5	L	L		M	L			M		H		L		H	M	L
18CPE $22	L	L	L	H	L	L	M	M	M	M	M	L	L	H	L	M

L-Low, M-Moderate (Medium), H-High

18CPE$23	HYDROLOGY

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1. 18CPC603 Water Resources Engineering

COURSE OBJECTIVES:

* To impart knowledge on hydrological cycle, spatial and temporal variations of rainfall and their analysis.
* To understand the importance of hydrographs for flood frequency analysis.
* To obtain the knowledge on the design of well system and predict the future floods and identify their routing.

UNIT – I : HYDROMETEOROLOGY (9 Periods)

Hydrological cycle – Hydrometeorological factors – Cloud formation – Winds and their movement – Types of precipitation– Forms of pecipitation – Density and Adequacy of rain gauges – Recording and non - recording rain gauges – Optimum number of rain gauges.

UNIT – II : PRECIPITATION AND ABSTRACTIONS (9 Periods)

Spatial distribution – Consistency analysis – Frequency analysis – Intensity, duration, frequency relationships – Evaporation– Infiltration – Horton's equation – Infiltration indices – measurement of infiltration – abstraction loss.

UNIT – III : HYDROGRAPH ANALYSIS (9 Periods)

Flood Hydrograph – Components of flood hydrograph – Factors affecting shape of Hydrograph - Base flow separation– Unit hydrograph – Advantages – Instantaneous Unit hydrograph - S curve Hydrograph - Synthetic unit hydrograph –Applications.

UNIT – IV : GROUND WATER HYDROLOGY (9 Periods)

Occurrence of ground water – Types of aquifer – Dupuit's assumptions – Darcy's law – Estimation of aquifer parameters – Pump tests – Steady and unsteady state conditions - Discharge in a Confined and Unconfined Aquifers – Leaky aquifer – well loss – aquifer loss– problems.

UNIT – V : FLOOD ANALYSIS (9 Periods)

Flood estimation – Gumbel's method – Log Pearson type III method – Reservoir flood routing – Channel routing – Types of streams – Stage discharge relationships - Flow measurements – Current meter method for velocity measurements.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Santosh Kumar Garg, **"Hydrology and Water Resources Engineering"**, Khanna Publications Pvt. Ltd., NewDelhi, 2017.*
2 *Jayaramy Reddy. P., **"Hydrology"**, Tata McGraw-Hill Publications Pvt.Ltd, New Delhi, 2016.*

REFERENCE BOOKS:

1 *Subramanya. K., **"Engineering Hydrology"**, Tata McGraw-Hill Publications Pvt. Ltd, New Delhi, 2017.*
2 *Warren Viessman and Gary L. Lewis, **"Introduction to Hydrology"**, Prentice Hall of India Pvt. Ltd, New Delhi, 2003.*
3 *David K. Todd and Larry W. Mays, **"Groundwater Hydrology"**, Wiley Publications Pvt. Ltd, New Delhi, 2011.*

COURSE OUTCOMES:

On Completion of the course, the students will be able to:
CO1: Identify the behavior of water molecules in atmosphere.
CO2: Outline the meteorological data for forecasting analysis.
CO3: Identify the needs and importance of hydrographs in Run-off studies.
CO4: Obtain the knowledge on the design of open and tube wells for different aquifers.
CO5: Predict the future floods and identify the importance of flood routing.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M		L		L			L					H	L	M
CO2	H			M			L			L	M			M	L	H
CO3	L	M					L	L			H	M		H	M	L
CO4	L	H		H	L		H		L	M			L	H	M	L
CO5	M			L	L	M			M	M	L			M	L	
18CPE $23	M	M		L	L	M	L	L	L	M	H	M	L	H	L	L

L-Low, M-Moderate (Medium), H-High

18CPE$24	MAINTENANCE AND REHABILITATION OF STRUCTURES

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES403 Construction Materials and Technology

COURSE OBJECTIVES:

* To gain the knowledge on quality of concrete, durability aspects and causes of deterioration.
* To understand the assessment procedure of distressed structures, repairing of structures.
* To understand the demolition procedures for damaged structures.

UNIT – I : MAINTENANCE AND REPAIR STRATEGIES (9 Periods)

Maintenance – repair and rehabilitation – Facets of Maintenance – Importance of Maintenance – Various aspects of Inspection – Assessment procedure for evaluating a damaged structure – Structural audit –Causes of deterioration – Diagnosis of causes and preventive measures.

UNIT – II : SERVICEABILITY AND DURABILITY OF CONCRETE (9 Periods)

Quality assurance for concrete construction – Factors affecting concrete properties – Strength, permeability, thermal properties – Effects due to climate, temperature, chemicals, aggressive environment – Design and construction errors –Types of cracks – Causes and effects of cracks – Causes and effects of corrosion – Cover thickness requirements.

UNIT – III : MATERIALS FOR REPAIR (9 Periods)

Materials for accelerated strength gain – Concrete chemicals – Expansive cement – Ferro cement, Polymer concrete – Sulphur infiltrated concrete – Foamed concrete – Fibre reinforced concrete.

UNIT – IV : TECHNIQUES FOR REPAIR AND DEMOLITION (9 Periods)

Rust eliminators and polymer coating for rebars during repair – Mortar and dry pack method – Vacuum concreting – Guniting and Shotcreting – Epoxy injection – Shoring and underpinning – Methods of corrosion protection – Corrosion inhibitors, coating and cathodic protection – Engineered demolition techniques for Dilapidated structures – Case studies.

UNIT – V : REPAIRS, REHABILITATION AND STRENGTHENING OF STRUCTURES (9 Periods)

Repairs to overcome deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure – Strengthening of Super Structures – Jacketing – Reinforcement addition, Plating, Conversion to composite construction – Post stressing – Strengthening of substructures– Case studies.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1 *Dr. B. Vidivelli, **"Rehabilitation of concrete structures"**, Standard Publishers, 2011.*
2 *Hand Book on **"Repairs and Rehabilitation of RCC Buildings"** published by CPWD, Govt. of India, New Delhi, 2011.*

REFERENCE BOOKS:

1 *Bhattecharjee, **"Concrete Structures Repair Rehabilitation and Retrofitting"**, CBS Publishers and Distributors, New Delhi, 2017.*
2 *Poonam I. Modi, Chirag N. Patel,**"Repair & Rehabilitation of Concrete Structures"**, PHI Learning Pvt. Ltd., New Delhi, 2016.*
3 *Dr. R. Saravanan R. Dineshkumar, **"Repair and Rehabilitation of Structures"**, Lakshmi Publications, Chennai, 2013.*
4 *M. S. Shetty, **"Concrete Technology – Theory and Practice"**, S. Chand and Company, New Delhi, 2008.*

COURSE OUTCOMES:

On completion of the course, the students will be able to
CO1: Identify the causes of deterioration and carryout structural audit.
CO2: Assess the quality assurance of the construction.
CO3: Identify and propose the appropriate materials and techniques for various repair conditions.
CO4: Execute various engineered demolition techniques for dilapidated structures.
CO5: Rehabilitate and strengthen the various elements of a structure subjected to deterioration.

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	--	L	M	L	M	--	--	--	--	--	M	--	--	H	--
CO2	M	--	L	L	L	H	--	--	--	--	--	L	M	--	L	M
CO3	M	--	L	M	L	M	--	--	--	--	--	M	L	--	--	L
CO4	M	--	--	M	L	H	--	--	--	--	--	L	L	--	M	H
CO5	M	--	--	M	L	M	--	--	--	--	--	L	--	--	M	--
18CPE $24	M	--	L	M	L	M	--	--	--	--	--	L	L	--	M	M

L-Low, M-Moderate (Medium), H-High

18CPE$25	PREFABRICATED STRUCTURES

Category : PE

L	T	P	C
3	0	0	3

PRE-REQUISITES:

1 18CES403 Construction Materials and Technology
2 18CPC404 Basic Structural Design I (Steel)
3 18CPC503 Basic Structural Design II (Concrete)

COURSE OBJECTIVES:

* To impart knowledge to students on modular construction and prefabricated components.
* To get exposure on the design concepts of prefabricated elements.
* To understand the methods of construction and installation of precast elements

UNIT – I : INTRODUCTION (9 Periods)

Prefabrication- Need of prefabrication - Comparison with monolithic construction – Advantages and Disadvantages - Methods of prefabrication – site and plant prefabrication – Types of precast systems - Modular coordination – Standardization- Tolerance.
Precast concrete – Materials-Cement, SCM, Aggregate, Water, chemical Admixtures, Pigments, reinforcement, Prestressing Tendons, Concrete and properties, Grouting and mortars.

UNIT – II : PREFABRICATED COMPONENTS (9 Periods)

Beams-Columns- Roof units- Floor units- wall panels – footings-Dimensions of prefabricated elements.

UNIT – III : PRODUCTION TECHNOLOGY (9 Periods)

Choice and planning of production setup – Manufacturing methods – Production process-Moulds – Acceleration of concrete hardening, Curing.

UNIT – IV :ANALYSIS, DESIGN AND JOINTS IN STRUCTURAL MEMBERS (9 Periods)

Loads-Load combination, - Disuniting of structures- Analysis of precast frames- Design of inverted Tee beam and L beam
Connection in precast building – Column to foundation connections, Wall panel to foundation connections, Beam to Column Connections, Column to column Connections, Floor to Beam Connections, Wall panel to Wall Panel Connection.

UNIT – V : HANDLING AND ERECTION (9 Periods)
Storage of precast elements - Equipments for hoisting and erection –Installation of precast element – Column, Wall, Beam, Slab – Transportation- Handling Equipments and Handling Devices - Vacuum lifting pads.

Contact Periods: Lecture: 45 Tutorial: 00 Practical: 00 Total : 45 Periods

TEXT BOOKS:

1. *L. Mokk, **"Prefabricated Concrete for Industrial and Public Structures"**, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.*
2 *K.M. Elliott, **"Precast concrete structures"**, Butterworth Heinmann, 2002.*

REFERENCE BOOKS:

1 *Structural Design Manual, **"Precast Concrete Connection Details"**, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 2009.*
2 *Ganesan and Latha, **"Prefabricated structures"**, Sree Kamalamani Publications, Chennai, 2014.*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Select materials and methods of prefabrication.
CO2: Outline the components of the prefabricated structures.
CO3: Plan the production process and identify the methods of prefabricated elements.
CO4: Carryout the analysis and design of members and joints of precast building.
CO5: Monitor the handling and installation of elements.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	L	L		M			M	H			M	M	M	H		L
CO2	L	L		M		M	L	H			L	L	L	H	L	
CO3	H	L	L	M	L	L	L	L	L		L	L		H	L	L
CO4	L	L	H	H		M			L					H	M	
CO5	L		H			H	L	M	L			L		H		L
18CPE $25	L	L	H	M	L	M	L	H	L		L	L	M	H	L	L

L-Low, M-Moderate (Medium), H-High

18COE$01	CLIMATE CHANGE AND ADAPTATION *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Able get knowledge about Climate system and its changes and causes
- Able to learn about impacts, adaptation and mitigation of climate change
- Able to learn about clean technology and clean energy

UNIT – I : EARTH'S CLIMATE SYSTEM **(9 Periods)**

Introduction-Climate in the spotlight - The Earth's Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies - Cloud Formation and Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation – The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

UNIT – II : OBSERVED CHANGES AND ITS CAUSES **(9 Periods)**

Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India – climate change modeling.

UNIT – III : IMPACTS OF CLIMATE CHANGE **(9 Periods)**

Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT – IV : CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES **(9 Periods)**

Adaptation Strategy/Options in various sectors – Water – Agriculture –- Infrastructure and Settlement including coastal zones – Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

UNIT – V : CLEAN TECHNOLOGY AND ENERGY **(9 Periods)**

Clean Development Mechanism – Carbon Trading - examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total : 45 Periods

TEXT BOOKS:

1 *Jan C. van Dam,* ***"Impacts of Climate Change and Climate Variability on Hydrological Regimes"****, Cambridge University Press, 2009.*
2 *Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds.,* ***"Climate Change and Water"****. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.*
3 *Dash Sushil Kumar,* ***"Climate Change – An Indian Perspective"****, Cambridge University Press India Pvt. Ltd, 2007.*
4 *IPCC Report Technical paper VI – Climate change and Water, 2008.*

REFERENCE BOOKS:

1 *IPCC fourth assessment report - The AR4 synthesis report, 2007*
2 *IPCC fourth assessment report –Working Group I Report, " The physical Science Basis",2007*
3 *IPCC fourth assessment report - Working Group II Report,* ***"Impacts, Adaptation and Vulnerability"****, 2007*
4 *Climate change 2014: Impacts, Adaptation and Vulnerability, IPCC*
5 *Climate change 2013: The Physical Science basis, IPCC.*
6 *www.environment.gov.au/climate-change/adaptation.*
7 *www.environment.org/explore-topics/climate-change/what.we.do/climate-adaptation.*

COURSE OUTCOMES:

On completion of the course, the students will be able to
CO1: Understand the climatic system and the factors influencing the climatic changes
CO2: Assess the uncertainty and impact of climatic changes
CO3: Understand the impacts of climate change in various sectors.
CO4: Develop strategies for adaptation and mitigation of climatic changes
CO5: Identify clean technologies for sustainable growth

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1			M			L	L					L	L	L	L	L
CO2	L					L	L					L	M	M	M	L
CO3						L	L					L		H	H	
CO4	M	M	L	M		L	M					L	L	M	M	M
CO5	L	M	M	M		L	H					L	L	M	L	M
18COE $01	L	M	M	M		L	M					L	L	M	M	M

L-Low, M-Moderate (Medium), H-High

18COE$02	DISASTER MANAGEMENT AND MITIGATION *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To give knowledge about basics of Disaster Management.
- To impart knowledge about Hazards and Vulnerability.
- To give knowledge about mitigation and preparedness.
- To teach about Response and Recovery.
- To impart knowledge about the participants involved in the disaster management activity.

UNIT - I : INTRODUCTION (9 Periods)

Disaster throughout history, History of disaster management, Capacity by demand, UN International strategy for disaster reduction, the Hyogo framework for action, Post 2015 framework, Disaster trends.

UNIT – II : HAZARDS AND RISK VULNERABILITY (9 Periods)

Hazard Identification and Hazard Profiling, hazard analysis, Types of hazards- Natural and technological Components of Risk- likelihood and Consequence, Trends and Computation of likelihood and Consequence. Risk Evaluation – purpose, Risk Acceptibility, Alternatives, Personnel. Political/ social, Economic. vulnerability-Physical Profile, Social Profile, Environmental Profile, Economic Profile. Factors Influncing Vulnerability, risk Perception.

UNIT - III : MITIGATION AND PREPAREDNESS (9 Periods)

Mitigation - types of mitigation ,Ostacles in mitigation, Assement and selection of Mitigation options, Emergency response capacity as , Incorporating Mitigation into development and relief projects. Prepareness- Government Preparedness, Public Preparedness, Media as a public educator. Obstacles to public education and preparedness.

UNIT – IV : RESPONSE AND RECOVERY (9 Periods)

Response the Emergency- Pre disaster, post disaster, Provision of water, food and shelter, volunteer management , command , control and coordination. Recovery- short term and long term recovery components of recovery- planning, coordination, information, money and supplies, allocation of relief funds, personnel. Types of recovery- Government, Infrastructure, Debris removal disposal and processing, environment, housing, economic and livelihood, individual, family and social recovery-special considerations in recovery.

UNIT – V : PARTICIPANTS (9 Periods)

Governmental Disaster management agencies- Fire, law, emergency management, Emergency medical service, Millitary and other resources. Structures- local, regional, national. Bilateral assistance and its types. Types of national agencies involved in international disaster management. Political implications of bilateral assistance.
Non GovernmentalOrganaisations – operations, NGO/ Millitary coordination, standard of conduct.
The role of Private sector and academia.
Multilateral organaisations - UN agencies and progammes, Regional &Inernationalorganaisations. International Financial Institutions- the world bank, IMF, ADB, IADB. Special considerations.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total : 45 Periods

TEXT BOOKS:

1. *Damon P. Coppola, **"Introduction to International Disaster management"**, Elsevier publication, 2015*

REFERENCE BOOKS:

*1. Brassard, Caroline, Giles, David W., Howitt, Arnold M., **"Natural Disaster Management in the Asia-Pacific"**, Policy and Governance.*
*2. **"Disaster Management",** Global Challenges and Local Solutions, Universities Press, 2009.*
*3. Jack Pinkowski, **"Disaster Management Handbook"**, CRC Press , January 22, 2008.*
4. Disaster Management Guidelines, GOI-UNDP Disaster Risk Reduction Programme (2009-2012).

COURSE OUTCOME:

On completion of the course, the students will be able to
CO1: Able to get knowledge about basics of Disaster management.
CO2: Able to impact knowledge about Hazards and vulnerability
CO3: Able to know about Mitigation and preparedness.
CO4: Able to attain knowledge about response and recovery.
CO5: Able to learn about the participants involved in the disaster management activity.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS01	PS02	PS03	PS04
CO1		L			L	L		L								L
CO2	L	H		M	L	M						L	L			L
CO3	L	L			H	M						L	L			L
CO4	L	M		L	L	M	M									L
CO5		M		L	L	M										L
18COE $02	L	M		L	L	M	M					L	L			L

L-Low, M-Moderate (Medium), H-High

18COE$03	**ENERGY EFFICIENT BUILDINGS** *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To understand the Concepts of Sustainable Environment, basics of energy analysis, simulation and management.
- To understand the concept of managing air quality.
- To understand the Green building concepts.

UNIT – I : INTRODUCTION (9 Periods)

Life cycle impacts of materials and products – sustainable design concepts – strategies of design for the environment -the sun-earth relationship and the energy balance on the earth's surface, climate, wind – solar radiation and solar temperature – sun shading and solar radiation on surfaces – energy impact on the shape and orientation of buildings – thermal properties of building materials.

UNIT – II : ENERGY EFFICIENT TECHNIQUES (9 Periods)

Passive Cooling And Day Lighting – Active Solar And Photovoltaic- Building Energy Analysis Methods- Building Energy Simulation- Building Energy Efficiency Standards- Lighting System Design- Lighting Economics and Aesthetics- Impacts of Lighting Efficiency – Energy Audit and Energy Targeting- Technological Options For Energy Management.

UNIT – III : INDOOR ENVIRONMENTAL QUALITY MANAGEMENT (9 Periods)

Psychrometry- Comfort Conditions- Thermal Comfort- Ventilation And Air Quality Air Conditioning Requirement- Visual Perception- Illumination Requirement- Auditory Requirement-Energy Management Options- Air Conditioning Systems- Energy Conservation In Pumps- Fans And Blowers-Refrigerating Machines- Heat Rejection Equipment- Energy Efficient Motors- Insulation.

UNIT – IV : GREEN BUILDING CONCEPTS (9 Periods)

Green Building Concept- Green Building Rating Tools- Leeds And IGBC Codes. – Material Selection Embodied Energy- Operating Energy- Façade Systems- Ventilation Systems- Transportation- Water Treatment Systems- Water Efficiency- Building Economics.

UNIT – V : GREEN BUILDING DESIGN CASE STUDY (9 Periods)

Students To Work Through A Controlled Process of Analysis And Design To Produce Drawings and Models Of Their Own Personal Green Building Project. Topics Include Building Form, Orientation and Site Considerations; Conservation Measures; Energy Modeling; Heating System And Fuel Choices; Renewable Energy Systems; Material Choices; and Construction Budget-Students Will Research Green Construction and Design in A Particular -Construction Context and Report Their Results to the Class.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total : 45 Periods

TEXT BOOKS:

1 *Kibert, C.* ***"Sustainable Construction: Green Building Design and Delivery"****, John Wiley & Sons, 4th Edition, 2016.*
2 *Edward G Pita,* ***"An Energy Approach- Air-Conditioning Principles and Systems"****, Pearson Education, 2003.*
3 *Satyajit Ghosh, Abhinav Dhaka,* ***"Green structures: Energy efficient buildings"****, 2015.*

REFERENCE BOOKS:

1 *Colin Porteous,* ***"The New Eco-Architecture"****, Spon Press, 2002.*
2 *Ganesan T P,* ***"Energy Conservation in Buildings"****, ISTE Professional Center, Chennai, 1999.*
3 *NPTEL* ***"Energy Efficiency and Simulation"****, Prof.E.Rajsekar., IIT Roorkee.*
4 *Energy Conservation Building Codes: www.bee-india.nic.in*
5 *Lever More G J,* ***"Building Energy Management Systems"****, E And FN Spon, London, 2000.*
6 *NPTEL* ***"Energy efficiency acoustics and day lighting in building"****, Prof.B.Bhattacharjee., IIT Delhi.*

COURSE OUTCOMES:

On completion of the course, the students will be able to
CO1: Understand the Concepts of Sustainable Environment.
CO2: Understand the basics of energy analysis, simulation and management.
CO3: Understand the concept of managing air quality.
CO4: Understand the Green building concepts.
CO5: Create drawings and models of their own personal green building project

COURSE ARTICULATION MATRIX:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	L	M	L			M	M	L	L	L		L	L	M	L	L
CO2			L	L		L	L					L		L		
CO3		L				L	M	L				L		L		
CO4	L	M					H					M		M		
CO5	M	M	H	L			H	L	M		M	M		H	L	M
18COE $03	L	M	H	L		M	H	L	L	L	M	M	L	H	L	M

L-Low, M-Moderate (Medium), H-High

18MOE$04	NANOTECHNOLOGY AND SURFACE ENGINEERING *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To Understand and analyze the concepts of Quantum confinement, Dimensional structures and Properties of Nanosystems
- To be familiar with various methods of synthesis of Nanomaterials
- To analyze and understand the mechanical and electrical properties of Nanomaterial and its applications

UNIT – I: PROPERTIES OF NANOMATERIALS (9 Periods)

Size effect and properties of nanoparticles - particle size - particle shape - particle density - melting point, surface tension, wettability - specific surface area and pore size – Properties of Individual nanoparticles. Quantum confinement in 3D, 2D, 1D and zero dimensional structures -Size effect and properties of nanostructures- Top down and Bottom up approach.

UNIT – II : SYNTHESIS OF NANOMATERIALS (9 Periods)

Sol-Gel Process - Self-assembly – Electro deposition - Spray Pyrolysis - Flame Pyrolysis – Metal nano-crystals by Reduction – Solvo-thermal Synthesis - Chemical Vapor Deposition (CVD) – Metal Orgonic Chemical Vapor Deposition (MOCVD).Ball Milling - Inert Gas Condensation Technique (IGCT) – Thermal evaporation – Pulsed Laser Deposition (PLD) – DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE) – Melt Spinning process – Applications

UNIT – III : MECHANICAL AND ELECTRICAL PROPERTIES (9 Periods)

Nanoscale Mechanics - Introduction – Mechanical properties – The Elasticity of Nanomaterials – Elasticity of Bulk Nanomaterials –Plastic Deformation of Nanomaterials – Crystals and Crystal Plasticity – From Crystal Plasticity to Polycrystal Plasticity.

Introduction - Energy Storage Basics - Electrical Energy Storage Devices and Impact of Nanomaterials - Electrochemical Properties of Nanoscale Materials - Aerogels and Structure-Directed Mesoporous and Macroporous Solids - Nanoparticles - Nanotubes, Nanowires, and Nanorolls

UNIT – IV : FUNDAMENTALS OF SURFACE ENGINEERING (9 Periods)

Surface engineering - classification, definition, scope and general principles, Conventional surface engineering - Surface engineering by material removal: Cleaning, pickling, etching, grinding, polishing, buffing / puffing, Surface engineering by material addition - From liquid bath, hot dipping, Electro-deposition / plating.

UNIT – V : SURFACE MODIFICATION (9 Periods)

Surface modification of steel and ferrous components - Pack carburizing, Aluminizing, calorizing, diffusional coatings (principle and scope of application), Surface modification using liquid/molten bath: Cyaniding, liquid carburizing (diffusion from liquid state), Surface modification using gaseous medium: Nitriding, Carbo-nitriding (diffusion from gaseous state).

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Kelsall Robert W, Ian Hamley and Mark Geoghegan, —**"Nanoscale Science and Technology"**, Wiley Eastern, 2004.*
2. *N John Dinardo, **"Nanoscale Charecterisation of Surfaces & Interfaces**", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000*
3. *ASM Metals Hand Book –Vol. 5, **"Surface Engineering"**, 1996*

REFERENCE BOOKS:

1. *G. Timp. Editor, **"Nanotechnology"** AIP press, Springer-Verlag, New York, 1999*
2. *Hari Singh Nalwa, Editor, **"Nanostructured materials and Nanotechnology''**, Concise Edition, Academic Press, USA (2002).*
3. *GuozhongGao,**"Nanostructures & Nanomaterials: Synthesis, Properties & Applications**", Imperial College Press (2004).*
4. *K.G. Budinski, **"Surface Engineering for Wear Resistances",** Prentice Hall, Englewood Cliffs, 1988.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Analyze the particle size, particle shape, particle density, Size effect and properties of Nanostructures.

CO2: Acquire knowledge in various methods of synthesis of Nanomaterials.

CO3: Analyze the Elasticity of Nanomaterials, Electrical Energy Storage Devices and Aerogels.

CO4: Apply various Nanomaterials to the LED, Transistor Applications.

CO5: Apply various surface engineering techniques

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	L	L	M	L	M	M	M	L	M	M	M	M	M
CO2	H	H	M	H	H	L	L	M	M	M	L	H	M	H	M
CO3	H	H	L	H	M	M	L	L	M	M	M	M	M	H	M
CO4	L	H	M	H	M	M	L	L	M	M	M	M	M	H	M
CO5	M	M	L	M	M	L	M	M	M	L	M	M	M	H	M
18MOE$04	H	H	L	M	H	M	H	H	M	H	M	M	M	M	M

L-Low, M-Moderate (Medium), H-High

18MOE$05	**MECHATRONICS** *(Common to All Branches)*

Category : OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To study the mechatronics system and understanding the concepts of integration and design of mechatronics system.

UNIT – I : SYSTEM MODELS **(9 Periods)**

Introduction - Definition of Mechanical Systems, Philosophy and approach. Systems and Design - Mechatronic approach, Integrated Product Design - Modeling- Analysis and Simulation, Man-Machine Interface.

UNIT – II : SENSORS AND TRANSDUCERS **(9 Periods)**

Sensors and transducers - classification, Development in Transducer technology, Optoelectronics - Shaft encoders, CD Sensors, Vision System.

UNIT – III : DRIVES AND ACTUATORS **(9 Periods)**

Drives and Actuators - Hydraulic and Pneumatic drives - Electrical Actuators - servo motor and Stepper motor, Drive circuits, open and closed loop control - Embedded Systems - Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems.

UNIT – IV : SMART MATERIALS **(9 Periods)**

Smart materials - Shape Memory Alloy, Piezoelectric and Magnetostrictive Actuators - Materials, Static and dynamic characteristics, illustrative examples for positioning, vibration isolation.

UNIT – V : MICROMECHATRONIC SYSTEMS **(9 Periods)**

Micromechatronic systems - Microsensors, Microactuators - Micro-fabrication techniques - LIGA Process- Lithography, etching, Micro-joining. Application examples - Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.

Contact Periods:

Lecture: 45Periods **Tutorial: 0Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOKS:

*1. W.Bolton, **"Mechatronics"**, Longman,2nd Edition,1999*

REFERENCE BOOKS:

1. *Michael B. Histand and David G.Alciatore, **"Introduction to Mechatronics and Measurement Systems"**, Tata McGraw Hill, 2nd Edition,2003*
2. *D.A.Bradley, D.Dawson, N.C.Buru and A.J.Loader**, "Mechatronics"** Chapman and Hall, 1993*
3. *Dan S Necsulescu, **"Mechatronics"**, Pearson Education Asia, 2005*
4. *Devdas Shetty, Richard A. Kolk, **"Mechatronics System Design"**, Thomson, PWS publishing, 2007.*
5. *Smaili.A and Mrad.F, **"Mechatronics: Integrated Technologies for Intelligent Machines"**, Oxford university press, 2008.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Identify the key elements of mechatronics system and models.

CO2: Select appropriate sensors and transducers for industrial application.

CO 3: Integrate mechanical, electrical, electronics, control systems in the mechatronics system design

CO 4: Select the proper smart material for mechatronics system.

CO 5: Apply the principles of mechatronics in industrial needs.

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	H	M	L	H	L	L	H	L	M	L	M	H	L
CO2	H	H	H	L	L	H	L	L	M	L	M	L	M	H	L
CO3	H	H	H	L	L	H	L	L	M	L	M	L	M	H	L
CO4	H	H	H	M	H	H	L	L	M	M	L	L	H	H	L
CO5	H	H	H	M	L	H	L	L	H	M	M	M	H	H	L
18MOE$05	H	H	H	H	L	H	L	L	M	L	M	L	M	H	L

L-Low, M-Moderate (Medium), H-High

18EOE$07	RENEWABLE POWER GENERATION SYSTEMS *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To elucidate the technologies used for generation and utilization of power from renewable energy resources.

UNIT-I : SOLAR ENERGY **(9 Periods)**

Solar radiation, solar spectra-latitude and longitude, Declination angle, solar window, cosine law, seasonal variations, hour angle, calculation of angle of incidence, angstroms equation and constants, Photo voltaic: p-n junctions. Solar cells, PV systems, Standalone, Grid connected solar power - Types of solar thermal collectors – Flat and concentrating collectors, solar thermal applications -water heaters, dryers, stills, refrigeration, air-conditioning, solar pond, central receiver power generation.

UNIT-II : WIND ENERGY **(9 Periods)**

Wind energy - Basic principle of wind energy conversion system, wind data and energy estimation, site selection, components of wind energy conversion systems, design consideration of horizontal axis wind mill- merits and limitations- application.

UNIT-III : BIOMASS ENERGY **(9 Periods)**

Biomass, sources of biomass, thermo-chemical and bio-chemical conversion of biomass - Pyrolysis, gasification, combustion and fermentation. Gasifiers – Up draft, downdraft and fluidized bed gasifier. Digesters - Fixed and floating digester biogas plants, economics of biomass power generation.

UNIT-IV : OCEAN AND GEOTHERMAL ENERGY **(9 Periods)**

Ocean energy resources - Principles of ocean thermal energy conversion systems - ocean thermal power plants - Principles of ocean wave energy conversion and tidal energy conversion - Difference between tidal and wave power generation, Economics of OTEC.

Definition and classification of Geothermal resources, Utilization for electricity generation and direct heating, Wellhead power generating units. Overview of micro and mini hydel power generation.

UNIT-V : RENEWABLE ENERGY POLICIES **(9 Periods)**

Renewable energy policies - Feed-in tariffs, portfolio standards, policy targets, tax incentives, and biofuels mandates. International policies for climate change and energy security. Economic analysis and comparisons, Life cycle analysis, financial analysis, cost of conserved energy, and externalities. Cost assessment of supply technologies versus energy - Efficiency.

Contact Periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOKS:

1. *Rao. S. and Dr. Pamlekar B.B **"Energy Technology"** Khanna Publishers, Second Ed. 2016*
2. *Rai , G.D., **"Non-Conventional sources of Energy"**, Khanna Publishers , V Ed.,2016*

REFERENCE BOOKS:

1. *Khan. B.H, "Non-Conventional Energy Resources", The McGraw Hills, Second edition, 2016.*
2. *Bansal NK, Kleeman and Meliss, M "**Renewable Energy Sources and Conversion Techniques**", Tata McGraw Hill, 1996*
3. *Roland Wengenmayr, Thomas Buhrke," Renewable energy: Sustainable energy concepts for the future", Wiley-VCH, 1st edition, 2008.*

COURSE OUTCOMES:

On completion of the course students will be able to

CO1: Understand the concept of various Non-Conventional energy resources

CO2: Familiarize the principles of operation of renewable energy technologies

CO3: Realize the need for utilizing the energy from clean and Sustainable energy resources.

CO4: Interpret advantages and disadvantages of different renewable sources of energy

CO5: Comprehend the environmental aspects and the correlation between different operational parameters

CO6: Evaluate the options and estimate the energy generation through renewable sources

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	M	M	-	M	H	-	-	-	-	-	H	M	M
CO2	H	H	M	L	M	M	M	L	-	-	-	-	H	H	H
CO3	H	M	M	M	M	M	M	-	-	-	-	-	M	H	H
CO4	M	H	M	L	M	H	M	-	-	-	-	-	H	H	H
CO5	M	H	L	H	M	M	M	-	-	-	L	-	M	H	M
CO6	H	M	M	L	M	M	M	-	L	-	L	-	M	H	M
18EOE $07	H	H	M	M	-	M	M	L	L	-	L	-	H	H	H

L - Low, M - Moderate (Medium), H – High

18EOE$08	**ELECTRIC VEHICLES** *(Common to All Branches)*

Category : OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the technology of Electric and Hybrid Electric Vehicles and their business perspective

UNIT-I : INTRODUCTION (9 Periods)

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.
Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT-II : ELECTRIC TRAINS (9 Periods)

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives- drive system efficiency.

UNIT-III : ANALYSIS OF ENERGY STORAGE (9 Periods)

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

UNIT-IV : ENERGY MANAGEMENT STRATEGIES (9 Periods)

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

UNIT-V : BUSINESS PERSPECTIVE OF ELECTRIC VEHICLE (9 Periods)

Design of a Hybrid Electric Vehicle (HEV) - Design of a Battery Electric Vehicle (BEV) Hybrid Electric Heavy Duty Vehicles, Fuel Cell Heavy Duty Vehicles. Business: E-mobility business, electrification challenges, Connected mobility and Autonomous mobility- case study: E-mobility Indian Roadmap Perspective. Policy: EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Mehrdad Ehsani, Yimin Gao, Sebatien Gay and Ali Emadi, "**Modern Electric, Hybrid Electric and Fuel cell vehicles: Fundamentals, Theory and Design**", CRC press, 2004.*
2. *C. Mi, M. A. Masrur and D. W. Gao, "**Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives**", John Wiley & Sons, 2011.*
3. *S. Onori, L. Serrao and G. Rizzoni, "**Hybrid Electric Vehicles: Energy Management Strategies**", Springer, 2015.*

REFERENCE BOOKS:

1. *James Larminie and John Loury, "**Electric Vehicle Technology – Explained**", John Wiley & Sons Ltd, 2003.*
2. *Sandeep Dhameja, "**Electric Vehicle Battery Systems**", Butterworth – Heinemann, 2002.*
3. *Ronald K Jurgen, "**Electric and Hybrid – Electric Vehicles**", SAE, 2002.*
4. *Ron Hodkinson and John Fenton, "**Light Weight Electric/ Hybrid Vehicle Design**", Butterworth – Heinemann, 2001.*
5. *T. Denton, **"Electric and Hybrid Vehicles"**, Routledge, 2016.*

COURSE OUTCOMES:

On completion of the course students will be able to

CO1: Understand the basics of electric vehicle components and configuration.

CO2: Analyze suitable drive scheme for developing an electric vehicle.

CO3: Able to opt a proper energy management system.

CO4: Analyze the performance of practical HEV and EV.

CO5: Understand the infrastructure for Electric Vehicles and business potential.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
CO2	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
CO3	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
CO4	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
CO5	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-
18EOE $08	-	M	M	M	-	M	M	-	-	-	-	L	M	M	-

L - Low, M - Moderate (Medium), H – High

18EOE$09	**SMART GRID SYSTEMS** *(Common to All Branches)*

Category : OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

***** To comprehend the underlying techniques applied to Smart Grid

UNIT-I : BASICS OF POWER SYSTEMS **(9 Periods)**

Basics of Power Systems: Load and Generation - Power Flow Analysis- Economic Dispatch and Unit Commitment Problems. Smart Grid: Definition – Applications- Government and Industry-Standardization

UNIT-II : SMART GRID COMMUNICATIONS **(9 Periods)**

Two-way Digital Communications Paradigm - Network Architectures - IP-based Systems - Power Line Communications - Advanced Metering Infrastructure

UNIT-III : WIDE AREA MEASUREMENT **(9 Periods)**

Sensor Networks - Phasor Measurement Units- Communications Infrastructure- Fault Detection and Self-Healing Systems -Applications and Challenges

UNIT-IV : SECURITY AND PRIVACY **(9 Periods)**

Cyber Security Challenges in Smart Grid - Load Altering Attacks- False Data Injection Attacks- Defense Mechanisms - Privacy Challenges- Cyber Security Standards

UNIT-V : ECONOMICS AND MARKET OPERATIONS **(9 Periods)**

Introduction, Reasons for restructuring / deregulation of power industry, Understanding the restructuring process - Entities involved. The market place mechanisms-Energy and Reserve Markets- Market Power - Generation Firms- Locational Marginal Prices= Financial Transmission Rights

Contact Periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOKS:

1. *Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage "**Smart Grid Technologies and applications"** John Wiley Publishers Ltd., 2012.*
2. *P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan "**Electrical Power Systems-Analysis, Security and Deregulation**" PHI Learning Private Limited, New Delhi, 2012.*

REFERENCE BOOKS:

1. *Lars T. Berger, Krzysztof Iniewski "**Smart Grid applications, Communications and Security**" John Wiley Publishers Ltd., 2012.*
2. *Yang Xiao, **"Communication and Networking in Smart Grids",** CRC Press Taylor and Francis Group, 2012.*
3. *Caitlin G. Elsworth, **"The Smart Grid and Electric Power Transmission"**, Nova Science Publishers Inc, August 2010.*

COURSE OUTCOMES:

On completion of the course students will be able to

CO1: Demonstrate the various aspects of the smart grid, including Technologies, Components, Architectures and applications

CO2: Creating a framework to operate the grid more effectively.

CO3: Evaluate the existing grid with respect to smart grid

CO4: Upgrade the existing grid to smart grid environment

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	L	L	M	H	L	M	M	M	H	M	H	M
CO2	L	L	M	M	M	M	M	L	M	M	M	M	M	M	H
CO3	-	-	-	M	M	M	M	M	M	M	M	H	M	M	M
CO4	L	-	-	M	M	M	H	-	M	M	M	H	M	H	H
18EOE $09	L	L	M	M	M	M	H	L	M	M	M	H	M	H	H

L - Low, M - Moderate (Medium), H - High

18LOE$10	**MOBILE COMMUNICATION** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the concept of Mobile radio propagation, cellular system design
- To understand mobile technologies like GSM and CDMA.
- To know the mobile communication evolution of 2G, 3G and 3 GPP in detail.
- To have overview of immerging technologies application.

UNIT I WIRELESS COMMUNICATION (9 periods)

Cellular systems- Frequency Management and Channel Assignment- types of handoff and their characteristics, dropped call rates & their evaluation -MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.

UNIT II WIRELESS NETWORKS (9 periods)

Wireless LAN – IEEE 802.11 Standards – Architecture – Services – Mobile Ad hoc Networks- WiFi and WiMAX - Wireless Local Loop.

UNIT III MOBILE COMMUNICATION SYSTEMS (9 periods)

GSM-architecture-Location tracking and call setup- Mobility management- Handover-Security-GSM SMS – International roaming for GSM- call recording functions-subscriber and service data mgt – Mobile Number portability -VoIP service for Mobile Networks – GPRS – Architecture-GPRS procedures-attach and detach procedures-PDP context procedure-combined RA/LA update procedures-Billing

UNIT IV MOBILE NETWORK AND TRANSPORT LAYERS (9 periods)

Mobile IP – Dynamic Host Configuration Protocol-Mobile Ad Hoc Routing Protocols– Multicast routing-TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing-Selective Retransmission – Transaction Oriented TCP- TCP over 2.5 / 3G wireless Networks.

UNIT V APPLICATION LAYER (9 periods)

WAP Model- Mobile Location based services -WAP Gateway –WAP protocols – WAP user agent profile- caching model-wireless bearers for WAP - WML – WMLScripts - WTA - iMode - SyncML.

Contact Periods:

Lecture: 45 Periods Tutorial:0 Periods Practical:0 Periods Total:45 Periods

TEXT BOOKS:

1. *John Schiller, "**Mobile Communications**", Second Edition, Pearson Education, 2003.*
2. *William Stallings, "**Wireless Communications and Networks**", Pearson Education, 2002.*

REFERENCES BOOKS:

1. *Kaveh Pahlavan, Prasanth Krishnamoorthy, "**Principles of Wireless Networks**", First Edition, Pearson Education, 2003.*
2. *Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "**Principles of Mobile Computing**", Springer, 2003.*
3. *C.K.Toh, "**AdHoc Mobile Wireless Networks**", First Edition, Pearson Education, 2002.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand GSM, CDMA concepts and architecture, frame structure, system capacity, services provided.

CO2: Study of evolution of mobile communication generations 2G, 2.5G, 3G with their characteristics and limitations.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	M	-	-	-	-	-	-	-	-	L	M	L	-
CO2	M	M	M	-	-	-	-	-	-	-	-	L	M	L	-
18LOE $10	M	M	M	-	-	-	-	-	-	-	-	L	M	L	-

L - Low, M - Moderate (Medium), H - High

18LOE$11	INTRODUCTION TO VLSI SYSTEM DESIGN *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce various aspects of CMOS logic design in combinational and sequential circuit to design CMOS VLSI system components

UNIT I: CMOS LOGIC DESIGN (9 Periods)

Inverter- CMOS Logic Gates: Compound Gates – Pass Transistors and Transmission Gates – Tristated – Multiplexers –CMOS Fabrication and Layout: Fabrication Process – Layout Design rule – Gate Layouts – Stick Diagrams – Design Partitioning

UNIT II: MOS TRANSISTOR THEORY (9 Periods)

Introduction – Long Channel I-V Characteristics – C-V Characteristics – Non-ideal I-V Effects – DC Transfer Characteristics – CMOS Technologies – Sources of Power Dissipation - Dynamic Power – Static Power.

UNIT III: COMBINATIONAL CIRCUIT DESIGN (9 Periods)

Circuit Families: Static CMOS – Ratioed Circuits – Cascode Voltage Switch Logic – Dynamic Circuits – Pass Transistor Circuits. Silicon-on-Insulator Circuit Design – Subthreshold Cirucit Design

UNIT IV: SEQUENTIAL CIRCUIT DESIGN (9 Periods)

Sequential static circuits – Circuit design of latched and flip-flops – Sequencing dynamic circuits – Synchronizers – Wave pipelining - VLSI clocking: CMOS clocking styles - Pipelined systems - Clock generation and distribution.

UNIT V: DESIGN OF VLSI SYSTEMS (9 Periods)

System Specifications – Structural Gate Level Modeling – Switch Level Modeling – Behavioral and RTL Modeling - Addition/subtraction – Comparators –counters —Multiplexers - Binary Decoders – Comparators – Priority Encoders – Latches - Flip-Flops and Registers – SRAM – DRAM – ROM.

Contact Periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOKS:

1. *N. Weste and David Money Harris, "**CMOS VLSI Design**", Fourth Edition, Pearson Education,2011.*
2. *Uyemura, John P, "**Introduction to VLSI Circuits and Systems**", Wiley & Sons, 8th Reprint 2009*

REFERENCE BOOKS:

1. *Jan M. Rabaey, "**Digital Integrated Circuits: A Design Perspective**", PHI, Second Edition, 2012.*
2. *R. Jacob Baker, "**CMOS: Circuit Design, Layout, and Simulation**", Wiley-IEEE, Revised Second Edition, 2008.*
3. *Pucknell, "**Basic VLSI Design**", Prentice Hall, 2006.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Realize the CMOS logic design

CO2: Acquire knowledge on combinational and sequential circuit design of CMOS logic

CO3: Use VLSI clocking styles and realize CMOS VLSI system components

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
CO2	M	M	M	-	-	-	-	-	-	-	-	L	M	L	L
CO3	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
18LOE $11	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L

L - Low, M - Moderate (Medium), H - High

18LOE$12	MICROCONTROLLER AND APPLICATIONS *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Describe the architecture of 8051 microcontroller.
- Develop assembly program for 8051.
- Apply the instruction set of 8051 to get effective programs.
- Design system in block level using microcontroller, memory devices, buses and other peripheral devices.
- Solve real life problem using microcontroller based systems.

UNIT I: MICROCONTROLLER **(9 Periods)**

Microcontroller Features – On chip oscillator, List of Special Function Registers (SFRs), On chip program memory, on chip data memory, I/O Ports, Watch Dog Timer, Architecture of 8051, Instruction set - Addressing modes.

UNIT II: ASSEMBLY LANGUAGE PROGRAMMING **(9 Periods)**

8051 Assembly Language Programming, Branch Instruction Programming -I/O Port Programming – Arithmetic and Logic Instruction Programming-code conversion programming.

UNIT III: PROGRAMMING IN C AND INTERFACING-I **(9 Periods)**

Timers & Counters programming - Serial Port Programming - Interrupts Programming .8255 Interfacing and Programming- External Memory Interfacing - LCD interfacing, LED Interfacing.

UNIT IV: INTERFACING-II **(9 Periods)**

Keyboard Interfacing - ADC, DAC interfacing –Temperature Transducer-Pressure and Displacement Transducer-Light Sensor - Optocoupler - Relays.

UNIT V: APPLICATIONS OF MICROCONTROLLERS **(9 Periods)**

Stepper Motor interface-Temperature Monitoring and Control System-Speed Control of a DC Motor - Digital Thermometer-Digital Frequency Meter.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Mohammad Ali Mazidi, Janice Gillispie Mazidi* ***"The 8051 Microcontroller and Embedded Systems (Using assembly and C)"*** *Pearson education/ Prentice Hall of India Pvt. Ltd., 2007.*
2. ***Ajit Pal,*** *"Microcontrollers : Principles and Applications"****, Prentice-Hall of India Pvt.Ltd; 1 edition (August 2011).***

REFERENCE BOOKS:

1. *Krishna Kanth, **"Microprocessor and Microcontroller Archotecture,Programming and System Design using 8085, 8086, 8051"**, Prentice Hall of India, 2011.*
2. *Kenneth J.Ayala, **"The 8051 Microcontroller"** 3rd edition,Thompson Delmar Learning,2007, New Delhi.*
3. *Jacob Fraden, **"Handbook of Modern Sensors: Physics, Design and Applications"**, 3rd ed, Springer, 2010.*
4. *Michael J. Pont, **"Embedded C"** Pearson Education India, 1st edition (*2007*);*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Describe the architectures of controller

CO2: Develop Assembly program applying Digital logic and mathematics using 8051 instruction set

CO3: Design microcontroller based system within realistic constraint like user specification, availability of components etc

CO4: Interface real world sensors

CO5: Solve real life problem and construct a complete system as a solution

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
CO2	M	M	M	-	-	-	-	-	-	-	-	L	M	L	L
CO3	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
CO4	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L
CO5	M	M	M	-	-	-	-	-	-	-	-	L	M	L	L
18LOE $12	M	M	M	-	-	-	-	-	-	-	-	L	H	L	L

L - Low, M - Moderate (Medium), H - High

18POE$13	**RAPID PROTOTYPING** *(Common to All Branches)*

Category: OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To educate students with fundamental and advanced knowledge in the field of Rapid Prototyping technology and the associated Aerospace, Architecture, Art, Medical and Industrial applications.

UNIT- I INTRODUCTION (9 Periods)

Need - Development of RP systems – Applications in Product Development - Virtual Prototyping- Rapid Tooling – Rapid Manufacturing - Classification of RP processes – Benefits - Applications

UNIT- II REVERSE ENGINEERING AND CAD MODELING (9 Periods)

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wireframe, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for RP- Case studies.

UNIT- III LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS (9 Periods)

Classification – Liquid based systems - Stereo lithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and application. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT- IV POWDER BASED RAPID PROTOTYPING SYSTEMS (9 Periods)

Selective Laser Sintering (SLS): Principle, process, indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications – case Studies, Selective Laser Melting and Electron Beam Melting

UNIT- V OTHER RAPID PROTOTYPING SYSTEMS (9 Periods)

Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, Demerits, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Bio Additive Manufacturing.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Chua Chee Kai and Leong Kah Fai **"Rapid Prototyping: Principles and Applications in Manufacturing",** John Wiley AND Sons, 1997*
2. *Paul F. Jacobs **"Stereo-lithography and other RP & M Technologies",** from Rapid Prototyping to Rapid Tooling, SME/ASME,1996*

REFERENCE BOOKS:

1. *Gibson, I., Rosen, D.W. and Stucker, B **"Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing",** Springer, 2010.*
2. *Chua, C.K., Leong K.F. and Lim C.S **"Rapid prototyping: Principles and applications",** second edition, World Scientific Publishers, 2010.*
3. *Gebhardt, A **"Rapid prototyping",** Hanser Gardener Publications, 2003.*
4. *Liou, L.W. and Liou, F.W **"Rapid Prototyping and Engineering applications: A tool box for prototype development",** CRC Press, 2011.*
5. *Hilton, P.D. and Jacobs, P.F **"Rapid Tooling: Technologies and Industrial Applications",** CRC press, 2005*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Appreciate the importance of computers and modern tools in manufacturing to reduce cost and matching the societal needs.

CO2: Create and analyze 2D and 3D models using CAD modeling software and integrating with manufacturing systems.

CO3: Understand the variety of Additive Manufacturing (AM) technologies apply to their potential to support design and manufacturing, case studies relevant to mass customized manufacturing.

CO4: Apply knowledge on latest techniques of manufacturing in their field of career

CO5: To monitor and control shop floor with the aid of computers

COURSE ARTICULATION MATRIX

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1			L				M						L	L	
CO2			M											M	L
CO3			L										M	L	
CO4			M		H	M	L						M	H	L
CO5		M				L					M		L	H	
18POE$13		M	M		M	L	L				L		M	M	L

L- Low, M – Moderate (Medium), H – High

18POE$14	**MANAGERIAL ECONOMICS** *(Common to All Branches)*

Category: OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the fundamental economic principles necessary for production managers.

UNIT- I FUNDAMENTALS OF MANAGERIAL ECONOMICS (9 Periods)

Goals and Constraints - The Nature and Importance of Profits - Understanding Incentives - Economic rationality, Scarcity and opportunity cost -Marginal and Incremental Analysis.

UNIT- II DEMAND ANALYSIS (9 Periods)

Demand and Supply -Market Equilibrium - Price Elasticity of Demand - Price Elasticity, Total Revenue, and Marginal Revenue - Factors Affecting Price Elasticity - Cross Price Elasticity - Income Elasticity of Demand - Other Elasticities, Elasticities for Nonlinear Demand Functions - Elasticity of Supply.

UNIT- III DEMAND THEORIES (9 Periods)

Choice and Utility Theory - Law of Diminishing marginal utility - Consumer Equilibrium - Consumer Surplus - Price effect, Substitution Effect and Income Effect.

UNIT- IV THEORY OF PRODUCTION AND COST (9 Periods)

The Production Function - Profit-Maximizing Input Usage - Isoquants and Isocosts - Cost Minimization and Optimal Input Substitution - The Cost Function - Breakeven analysis, Contribution analysis - Long-run Costs and Economies of Scale - Multiple Cost Functions and Economies of Scope - Learning curve.

UNIT- V THEORY OF MARKET AND PRICING (9 Periods)

The Nature of Industry - Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Product pricing.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Thomas and Maurice **"Managerial Economics: Concept and Applications",** McGraw-Hill, 2005*
2. *Maheshwari.Y **"Managerial Economics",** Prentice Hall of India, 2012*

REFERENCE BOOKS:

1. *D.N. Dwivedi, **"Managerial Economics",** Vikas Publishing house, 2015*
2. *Christopher R Thomas, S Charles Maurice, **"Managerial economics",** Mcgraw Hill, 2014*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Explain fundamentals of managerial economics.

CO2: Discuss the dynamics of market forces.

CO3: Explain about various theories of demand.

CO4: Discuss about the cost concepts related to production.

CO5: Describe about the theory of market and pricing method.

COURSE ARTICULATION MATRIX

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	L	L							L	M	M	L			L
CO2	L	L	L							M	M	L			L
CO3	L									L	M	L			L
CO4	L									L	L	L			L
CO5	L	M	M	L						L	M	L			L
18POE$14	L	L	L	L						L	M	L			L

L- Low, M – Moderate (Medium), H - High

18POE$15	HYDRAULICS AND PNEUMATICS *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students to design the hydraulic and pneumatic circuits for different applications.

UNIT- I BASIC PRINCIPLES (9 Periods)

Hydraulic Principles; Hydraulic Fluids; Hydraulic pumps – Classification, Characteristics, Pump Selection; Hydraulic actuators; Hydraulic valves – Pressure, Flow, Direction Controls, Applications, Symbols.

UNIT- II HYDRAULIC CIRCUITS (9 Periods)

Hydraulic circuits – Reciprocating, Quick Return, Sequencing, Synchronizing, Regenerative circuit, Double pump hydraulic system; Safety Circuits.

UNIT- III POWER GADGETS IN HYDRAULICS (9 Periods)

Accumulators – Classification, Circuits; Pressure Intensifier and Circuit; Mechanical-hydraulic servo system; Selection of components. Installation and Maintenance of Hydraulic power pack; Troubleshooting of fluid power circuits.

UNIT- IV PNEUMATIC SYSTEMS (9 Periods)

Pneumatic Fundamentals; Control Elements; Logic Circuits; Position sensing, Pressure sensing; Electrical controls: Various switches; Electro Pneumatic and Electro Hydraulic Circuits.

UNIT- V DESIGN AND SELECTION OF PNEUMATIC CIRCUITS (9 Periods)

Design of Pneumatic circuits – Classic, Cascade, Step counter; PLC and Microprocessors – Uses; Selection criteria for Pneumatic components; Installation and Maintenance of Pneumatic power pack; Fault finding; Case studies.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Anthony Esposito,* ***"Fluid Power with Applications",*** *Pearson Education India, 7th edition, 2013.*
2. *Andrew Parr,* ***"Hydraulics and Pneumatics:A Technician's and Engineer's Guide",*** *Butterworth-Heinemann, 3rd edition, 2011.*

REFERENCE BOOKS:

1. *DudleyA Pease and John J Pippenger* ***"Basic Fluid Power",*** *Prentice Hall PTR, 2nd edition 1987.*
2. *John J Pippenger and Tyler G Hicks* ***"Industrial Hydraulics",*** *McGraw Hill,2nd edition, 1970.*
3. *J. Michael, Pinches and HohnG.Ashby* ***"Power Hydraulics",*** *Prentice Hall, 1989.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Describe the principle of fluid power
CO2: Describe the components of hydraulics
CO3: Design the hydraulic circuits for automation
CO4: Describe the components of pneumatics
CO5: Design the pneumatic circuits for automation

COURSE ARTICULATION MATRIX

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	H										M			
CO2	M											M			
CO3	M	H										M			
CO4	M											M			
CO5	M											M			
18POE$15	M	H										M			

L- Low, M – Moderate (Medium), H - High

18NOE$16	MEASUREMENT AND CONTROL *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- To learn about the working of different analog and digital instruments.

UNIT I – INTRODUCTION TO MEASUREMENTS (9 Periods)

Significance of measurements – Methods of measurements – Classification of Instruments – Functions of Instruments and Measurement System – Elements of measurement system – Errors in measurement — Calibration of instruments: Methods & analysis – Introduction to Transducer & types.

UNIT II – STRAIN AND DISPLACEMENT MEASUREMENT (9 Periods)

Factors affecting strain measurements – Types of strain gauges – theory of operation – strain gauge materials – strain gauge circuits and applications of strain gauges.

Resistive potentiometer (Linear, circular and helical) – L.V.D.T., R.V.D.T. and their characteristics – variable inductance and capacitance transducers – Piezo electrical transducers – Hall Effect devices and Proximity sensors.

UNIT III – PRESSURE AND TEMPERATURE MEASUREMENT (9 Periods)

Mechanical devices like Diaphragm, Bellows, and Bourdon tube for pressure measurement – Variable inductance and capacitance transducers – Piezo electric transducers – L.V.D.T. for measurement of pressure.

Resistance type temperature sensors – RTD & Thermistor – Thermocouples & Thermopiles, Laws of thermocouple – Radiation methods of temperature measurement.

UNIT IV – FLOW AND LEVEL MEASUREMENT (9 Periods)

Differential pressure meters like Orifice plate, Venturi tube, flow nozzle, Pitot tube, Rotameter, Turbine flow meter, Electromagnetic flow meter and Ultrasonic flow meter.

Resistive, inductive and capacitive techniques for level measurement – Ultrasonic methods – Air purge system (Bubbler method).

UNIT V – AUTOMATIC CONTROL SYSTEM (9 Periods)

Elements of control systems – concept of open loop and closed loop systems – Controllers – Brief idea of proportional, derivative and integral – Pneumatic Controller – Hydraulic Controller.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS

1. *A.K. Sawhney, Puneet Sawhney **"A Course in Electronic and Electrical Measurements and Instrumentation"** S.K.Kataria & Sons, Delhi, 2014.*
2. *E. D. Doeblin, **"Measurement Systems: Application and Design",** McGraw – Hill Publication, 6th Edition 2017.*

REFERENCE BOOKS

1. *S. K. Singh,* ***"Industrial Instrumentation & Control"****, 3rd Edition, McGraw Hill, 2016.*
2. *A.K. Sawhney, Puneet Sawhney* ***"A Course in mechanical measurements and Instrumentation & Control"****, Dhanapat Rai & Co, 2012.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO 1: Explain the construction and working of instruments used for various measurements.

CO 2: Describe the methods of measurement, classification of transducers and to analyze error.

CO 3: Elaborate the basic concept of control system.

CO 4: Analyze the characteristics of various measuring instruments

CO 5: Suggest suitable instruments for a particular application

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	M	H	M	H	M	L	H	M	H	H	H	M	H
CO2	H	M	M	M	H	H	H	M	H	L	H	H	H	H	M
CO3	H	H	M	H	M	H	M	L	H	M	H	H	H	H	H
CO4	H	H	M	H	M	H	M	L	H	M	H	H	H	M	H
CO5	H	H	M	H	M	H	M	L	H	M	H	H	H	M	M
18NOE$16	H	H	M	H	M	H	M	L	H	M	H	H	M	H	M

L-Low, M-Moderate(medium), H-High

18NOE$17	**INDUSTRIAL AUTOMATION** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- To elaborate the basic concept of automation and the components required for automation

UNIT I – INTRODUCTION TO AUTOMATION (9 Periods)

Automation overview – requirement of automation systems – architecture of industrial automation system – power supplies and isolators –relays – switches –transducers – sensors –seal-in circuits – industrial bus systems : modbus and profibus.

(9 Periods)

UNIT II – AUTOMATION COMPONENTS

Sensors for temperature – pressure – force – displacement - speed – flow- level – humidity and pH measurement. Actuators – process control valves – power electronic drives DIAC- TRIAC – power MOSFET – IGBT. Introduction to DC and AC servo drives for motion control

UNIT III – PROGRAMMABLE LOGIC CONTROLLERS (9 Periods)

PLC Hardware – PLC programming – ladder diagram – sequential flow chart – PLC communication and networking – PLC selection – PLC installation – Advantages – Application of PLC to process control industries and Robotics.

UNIT IV – DISTRIBUTED CONTROL SYSTEM (DCS) (9 Periods)

Overview of DCS – DCS hardware – DCS software configuration – DCS communication – DCS supervisory computer tasks – DCS integration with PLC and Computers

UNIT V – SCADA (9 Periods)

Introduction - Supervisory Control and Data Acquisition Systems (SCADA) – SCADA HMI Essentials – SCADA Components – SCADA Configuration and Software – HMI hardware and software.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *John.W. Webb Ronald A Reis,* ***"Programmable Logic Controllers - Principles and Applications",*** *Prentice Hall Inc., 5th Edition, 2003.*
2. *M. P. Lukcas,* ***"Distributed Control Systems",*** *Van Nostrand Reinhold Co., 1986.*

REFERENCE BOOKS :

1. *Bela G Liptak,* ***"Process software and digital networks – Volume 3",*** *4th Edition, CRC press, 2012.*
2. *Romily Bowden,* ***"HART application guide and the OSI communication foundation",*** *1999*
3. *Frank D. Petruzella,* ***"Programmable Logic Controllers",*** *5th Edition, McGraw Hill, 2016.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO 1: Elaborate the basic architecture of automation systems

CO 2 : Describe the various sensors and actuators involved in industrial automation

CO 3: Construct ladder logic diagram using PLC basic functions, timer and counter functions for simple applications

CO 4: Illustrate the functionary components and supervisory control of DCS with relevant diagrams

CO 5: Describe the basics of SCADA technology

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	M	M	L	L	L	H	L	M	L	L	H	L	L
CO2	H	H	H	H	L	L	L	H	L	M	L	L	H	L	L
CO3	H	H	M	M	L	L	M	H	L	M	L	L	H	L	L
CO4	H	H	H	H	L	L	L	H	L	M	L	L	H	L	L
CO5	H	H	M	M	M	L	L	H	L	M	L	L	H	L	L
18NOE$17	H	H	M	M	L	L	L	H	L	M	L	L	H	L	L

L-Low, M-Moderate(medium), H-High

18NOE$18	**VIRTUAL INSTRUMENTATION** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- To confer applications of virtual instrumentation in various fields.

UNIT I – INTRODUCTION (9 Periods)

Virtual Instrumentation and LabVIEW - Evolution of LabVIEW - Difference between LabView and conventional languages - Sequencing and data flow - Graphical programming.

UNIT II – LabVIEW ENVIRONMENT (9 Periods)

Front panel - Block diagram - Icon and Connector - Control Palette - Function Palette-Tools Palette - Creating, editing, wiring, debugging and saving VIs - sub-VIs - creating sub-VIs - simple examples-Looping: For loop, while loop-Shift registers - case and sequence; structures, formula nodes.

UNIT III – PROGRAMMING TECHNIQUES (9 Periods)

Arrays - clusters, charts and graphs, - local and global variables - property node, string and file I/O.

UNIT IV – DATA ACQUISITION AND INSTRUMENT CONTROL (9 Periods)

DAQ – Components - Buffers: Buffered and non buffered I/O - Triggering - Analog I/O-Digital I/O - Counters and timers-Instrument control: VISA, GPIB, VXI and PXI

UNIT V – ADVANCED Lab VIEW AND APPLICATIONS (9 Periods)

Connectivity in LabVIEW: an introduction - IVI - Labwindows/CVI.
Applications of Lab VIEW: process control, physical, biomedical, Image acquisition and processing.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS

1. *Sanjay Gupta and Joseph John, **"Virtual Instrumentation using LabVIEW"** Tata McGraw-Hill, Second edition 2010*
2. *Gary Johnson, Richard Jennings **"Lab view graphical programming",** Tata McGraw Hill, 2011.*

REFERENCE BOOKS

1. *Lisa K Wells and Jeffrey Travels, **"Labview for everyone",** Prentice Hall, 3rd Edition 2009.*
2. *S. Gupta, J.P. Gupta, **"PC interfacing for data acquisition and process control",** 2nd Ed., Instrument Society of America, 2011*
3. *Jovitha Jerome, **"Virtual Instrumentation Using LabVIEW"** PHI Learning Pvt. Ltd 1st Edition, 2010*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO 1 Recognize the importance and applications of virtual instrumentation.

CO 2 Develop ability for programming in LabVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.

CO 3 Realize the basics of interfacing and programming using related hardware.

CO 4 condition the acquired signal from the transducer to standard data formats

CO 5 Develop real time applications using LabVIEW

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	H	M	M	L	L	L	H	L	M	M	M	H	M	M
CO2		H	H	H	L	L	L	H	L	M	M	M	H	M	M
CO3		H	M	M	L	L	M	H	L	M	M	M	H	M	M
CO4		H	H	H	L	L	L	H	L	M	M	M	H	M	M
CO5		H	M	M	M	L	L	H	L	M	M	M	H	M	M
18NOE$18	M	H	M	M	L	L	L	H	L	M	M	M	H	M	M

L-Low, M-Moderate(medium), H-High

18SOE$19	**PROGRAMMING IN JAVA** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Upon completion of this course the students will be familiar with:

- Basic programming constructs in java to develop simple object oriented programs.
- Exception handling, multi-threading and I/O programming
- Development of GUI applications
- Manipulation of images.
- Network Programming

UNIT – I : FUNDAMENTALS OF JAVA PROGRAMMING (9 Periods)

History and Evolution of Java- Overview of java– Operators- Control Structures– Methods- Classes and Objects– Inheritance- Packages and Interfaces- Exception Handling.

UNIT – II : THREADS , I/O AND STRING HANDLING (9 Periods)

Multi threaded Programming– Enumeration- Auto boxing– Annotations- String Handling-Input/Output: Exploring java.io.

UNIT – III : APPLETS AND EVENT HANDLING (9 Periods)

Applet class- Event Handling. Introducing the AWT: working with windows- graphics and text- Using AWT controls- Layout Manager - menus.

UNIT – IV : IMAGING AND DATABASE CONNECTIVITY (9 Periods)

Imaging: Creating- loading and displaying- Image observer- Double buffering- Media tracker- Image producer– consumer– filters– animation- Java Database Connectivity.

UNIT – V : NETWORKING (9 Periods)

Networking – Remote Method Invocation – Java Beans –Java servlets

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Herbert Schildt, **"Java, The Complete Reference** ", Tata McGrawHill, Eighth Edition, 2011.*

REFERENCE BOOKS:

1. *Deitel .H.M and Deitel.P.J,* ***"Java: How to Program",*** *Pearson Education Asia, Eighth Edition 2010.*
2. *Lay.S&Horstmann Gary Cornell,* ***"Core Java Vol I",*** *Seventh Edition, The Sun Microsystems & press Java Series, 2005.*
3. *Lay.S&Horstmann Gary Cornell,* ***"Core Java Vol II",*** *Eighth Edition, The Sun Microsystems & press Java Series, 2008.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Write simple java programs using fundamental concepts of java like control structures, inheritance, packages, interfaces and exception handling. [**Usage]**

CO2: Write java program using multithreading and string handling. [**Usage]**

CO3: Develop GUI based applications using Applets. [**Usage]**

CO4: Write java programs to display and manipulation of graphical images. [**Usage]**

CO5: Establish database connectivity.[**Familiarity]**

CO6: Develop client server programs using RMI and servlets. [**Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H		H	M	M				H	M	M	H	H	H
CO2	M	M	H		H	M	M				H	M	M	H	H	H
CO3	M	M	H		H	M	M				H	M	M	H	H	H
CO4	M	M	H		H	M	M				H	M	M	H	H	H
CO5	M	M	H		H	M	M				H	M	M	H	H	H
CO6	M	M	H		H	M	M				H	M	M	H	H	H
18SOE$19	M	M	H		H	M	M				H	M	M	H	H	H

L - Low, M - Moderate (Medium), H - High

18SOE$20	**CYBER SECURITY** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- Cybercrime and cyber offenses
- Cybercrime using mobile devices.
- Tools and methods used in cybercrime.
- Legal perspectives of cybercrime.
- Fundamentals of computer forensics.

UNIT – I : INTRODUCTION TO CYBERCRIME AND CYBEROFFENSES (9 Periods)

Cybercrime and Information Security - Classifications of Cybercrimes - The Legal Perspectives - Cybercrime and the Indian ITA 2000 - A Global Perspective on Cybercrimes - Plan of Attacks - Social Engineering – Cyberstalking - Cybercafe and Cybercrimes – Botnets - Attack Vector.

UNIT – II : CYBERCRIME: MOBILE AND WIRELESS DEVICES (9 Periods)

Proliferation of Mobile and Wireless Devices - Trends in Mobility - Credit Card Frauds in Mobile and Wireless Computing Era – Security challenges posed by mobile devices – registry setting for mobile devices – authentication service security – attacks on mobile/cell phones – Organizational measures for handling mobiles.

UNIT – III : TOOLS AND METHODS USED IN CYBERCRIME (9 Periods)

Proxy Servers and Anonymizers – Phishing - Password Cracking – Keyloggers – Spywares -Virus and Worms - Trojan Horses and Backdoors – Steganography - DoS and DDoS Attacks - SQL Injection - Attacks on Wireless Networks.

UNIT – IV : CYBERCRIMES AND CYBERSECURITY: THE LEGAL PERSPECTIVES (9 Periods)

Cyberlaws- The Indian Context - The Indian IT Act - Challenges to Indian Law and Cybercrime Scenario in India - Consequences of Not Addressing the Weakness in Information Technology Act - Digital Signatures and the Indian IT Act - Amendments to the Indian IT Act - Cybercrime and Punishment.

UNIT – V : UNDERSTANDING COMPUTER FORENSICS (9 Periods)

Digital Forensics - Forensics Analysis of E-Mail - Network Forensics - Forensics and Steganography - Forensics and Social Networking Sites - Challenges in Computer Forensics - Data Privacy Issues – Forensics Auditing – Antiforensics.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Nina Godbole and Sunit Belapur,* ***"Cyber Security Understanding Cyber Crimes, Compute Forensics and Legal Perspectives",*** *Wiley India Publications, April, 2011.*

REFERENCE BOOKS:

1. *Robert Jones,* ***"Internet Forensics: Using Digital Evidence to Solve Computer Crime",*** *O"Reilly Media, October, 2005.*
2. *Chad Steel, "****Windows Forensics: The field guide for conducting corporate computer investigations****", Wiley India Publications, December, 2006.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Explain the fundamental concepts of cybercrime and cyberoffenses. **[Familiarity]**

CO2: Describe the cybercrimes occurred in mobile and wireless devices. **[Familiarity]**

CO3: Elaborate the methods used in cybercrime. **[Familiarity]**

CO4: Explain the laws for cybercrime and its respective punishments. **[Familiarity]**

CO5: Explain the forensics Analysis of E-Mail, Network and Social Networking Sites **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	M	M	L	H	L	M				H	H	L	M	M
CO2	M	M	M	M	M	H	M	M				M	H	H	M	M
CO3	H	L	L	L	L	H	H	L				H	H	H	L	L
CO4	H	M	M	M	M	H	H	H				M	H	H	L	L
CO5	H	M	M	M	M	L	H	L				H	H	H	M	M
18SOE$20	H	M	M	M	M	H	H	M				H	H	H	M	M

L - Low, M - Moderate (Medium), H - High

18SOE$21	**NETWORK ESSENTIALS** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- Basic taxonomy and terminology of the computer networking
- Wireless networking
- Addressing and Routing
- Routing protocols
- Troubleshooting and security issues.

UNIT – I : INTRODUCTION (9 Periods)

Introduction to Computer Networks - Goals and advantages of Computer Networks - Network Topologies – Basic networking devices – Protocols – the need for a layered architecture - The OSI Model and the TCP/IP reference model – the Ethernet LAN – Home Networking – Assembling an office LAN – Testing and Troubleshooting a LAN – Physical layer cabling: Twisted pair and Fiber optics.

UNIT – II : WIRELESS NETWORKING (9 Periods)

Importance of Wireless Networking – IEEE 802.11 Wireless LANs – Bluetooth- WIMAX – RFIDs – Securing the Wireless LANs – Configuring a Point to Multipoint Wireless LAN – Interconnecting network LANs – Switch, Bridges and Routers. Interconnecting LANs with the router, Configuring the network interface-Auto negotiation.

UNIT – III : ADDRESSING AND ROUTING FUNDAMENTALS (9 Periods)

IPv4 and IPv6 addressing – Subnet masks – CIDR blocks – configuration of a router – Console port connection - user EXEC mode – Privileged EXEC mode - Configuration of a switch – Static VLAN configuration - Spanning Tree protocol – Network Management – Power over Ethernet.

UNIT – IV : ROUTING PROTOCOLS (9 Periods)

Static Vs Dynamic Routing Protocols – Distance vector Routing – Link State Routing – Hybrid Routing – Configuring RIP - Network Services – DHCP, DNS - Analyzing Internet Traffic.

UNIT – V : TROUBLESHOOTING AND NETWORK SECURITY (9 Periods)

Analyzing Computer Networks – FTP data packets – Analyzing Campus Network data traffic – Troubleshooting the router and switch interface, Troubleshooting fiber optics – Intrusion – DOS – Security software and hardware.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Jeffrey S.Beasley Piyasat Nilkaew **"Network Essentials"** 3rd Edition, Pearson, 2012*
2. *Larry L. Peterson and Bruce S. Davie **"Computer Networks, A Systems Approach"** 5th edition, Morgan Kaufmann Publishers Inc, 2011.*

REFERENCE BOOKS:

1. *Behrouz A.Ferouzan, **"Data Communications and Networking"**, 5th edition, Tata McGraw-Hill, 2012.*
2. *Andrew S. Tanenbaum, **"Computer networks"**, PHI, 5th edition 2011.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Identify topologies and types of Computer Networks and enumerate the layers of the OSI model and TCP/IP and Explain the functions of each layer **[Familiarity]**

CO2: Explain the significance of wireless networks and configure a Wireless LAN **[Assessment]**

CO3: Describe basic routing algorithms and network services. **[Familiarity]**

CO4: Troubleshoot the router and switch interface **[Usage]**

CO5: Analyze Campus Network data traffic **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H	H	H	L	L	H	H	H	H	H	M	H	H	M
CO2	L	L	L	L	H	L	L	H	L	L	L	H	M	H	H	M
CO3	L	H	M	M	H	L	L	H	H	M	L	H	L	H	H	L
CO4	H	H	H	M	H	L	L	H	H	H	M	H	M	H	H	M
CO5	H	H	H	M	H	L	L	H	H	M	L	H	M	H	H	M
18SOE$21	M	H	H	M	H	L	L	H	H	L	M	H	M	H	H	M

L - Low, M - Moderate (Medium), H - High

18IOE$22	**PROGRAMMING IN PYTHON** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- Data types and variables declaration.
- Control statements, Functions and the use of basic programming.
- List, dictionary and operations used in python.
- File and Exception handling.
- Object oriented programming and GUI development.

UNIT – I : INTRODUCTION (9 Periods)

Introduction to Python - Setting up Python in OS – Python IDLE(write- edit- run- and save programs) – Strings - Numbers – Variables – simple I/O - Getting user input– Using String method–Converting values.

UNIT – II : CONTROL STATEMENTS AND FUNCTIONS (9 Periods)

Control statements – Random number generator- Branching and loops – Range functions- Functions –User defined functions- passing parameters- return function- working with global variables and constants.

UNIT – III : LISTS AND DICTIONARIES (9 Periods)

Lists – create- index- slice a list- Add and delete elements from a list- Append- Sort and reverse a list- nested sequences- Dictionaries – Create- add- delete from a Dictionary- Operations associated with pairs of data.

UNIT – IV : FILES AND EXCEPTIONS (9 Periods)

Files – Read from text files- Write to text files- Read and write more complex data- Exceptions – Intercept and handle errors during program's execution.

UNIT – V : OBJECT ORIENTED PROGRAMMING AND GUI (9 Periods)

Object oriented programming – Create objects of different classes in the same program- objects communication- complex object creation- derive new classes- existing class extension- override method- GUI – GUI toolkit- create and fill frames- create buttons- text entries and text boxes- create check buttons and radio buttons - case study – create a web page using GUI functionality.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Y. Daniel Liang,* ***"Introduction to Programming Using Python",*** *Pearson, 2013.*
2. *David I.Schneider,* ***"Introduction to programming using python",*** *person, 2015.*

REFERENCE BOOKS:

1. *Michael Dawson,* ***"Python Programming for the Absolute Beginner",*** *Premier Press, 2003.*
2. *Charles Dierbach,* ***"Introduction to Computer Science Using Python: A Computational Problem-Solving Focus",*** *Wiley Publications, 2012.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to,

CO1: Use various data types. **[Understand]**
CO2: Use control statements and functions. **[Understand]**
CO3: Analyze the arrangement of data elements in Lists and Dictionary structures. **[Analyze]**
CO4: Handle exceptions and perform file operations**. [Understand]**
CO5: Develop application using object oriented programming and GUI. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L		L	L		L	L			L		L	L
CO2	M	L		L	L		L	L			L		L	L
CO3	M	M	L	M	L		L	L			L		M	L
CO4	M	M	L	M	L		M	M			L		M	L
CO5	M	M	L	M	L		M	M			M	L	M	L
18IOE $22	**M**	**M**	**L**	**M**	**L**		**M**	**M**			**L**	**L**	**M**	**L**

L - Low, M - Moderate (Medium), H – High

18IOE$23	**BIG DATA SCIENCE** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- Big Data and its characteristics.
- Technologies used for Big Data Storage and Analysis.
- Mining larger data streams.
- Concepts related to Link analysis and handle frequent data sets.

UNIT – I : THE FUNDAMENTALS OF BIG DATA **(9 Periods)**

Understanding Big Data-Concepts and Technology-Big Data Characteristics-Types of data-Case Study-Business Motivation and Drivers for Big Data Adoption- Planning Considerations-Enterprise Technologies and Big Data Business Intelligence- OLTP-OLAP-Extract Transform Load-Data Warehouses-Data Mart-Traditional and Big Data BI-Case Study.

UNIT – II : BIG DATA STORAGE AND PROCESSING **(9 Periods)**

Big Data Storage Concepts- Clusters-File systems and Distributed File Systems-NoSQL- Sharding -Replication -Sharding and Replication-CAP Theorem-ACID-BASE-Case Study- Big Data Processing Concepts- Parallel Data Processing-Distributed Data Processing-Hadoop-Processing Workloads-Cluster-Processing in Batch mode-Processing in RealTime mode-Case study

UNIT – III : BIG DATA STORAGE AND ANALYSIS TECHNOLOGY **(9 Periods)**

Big Data Storage Technology: On-Disk Storage devices-NoSQL Databases-In-Memory Storage Devices-Case study, Big Data Analysis Techniques: Quantitative Analysis-Qualitative Analysis-Data Mining-Statistical Analysis-Machine Learning-Semantic Analysis-Visual Analysis-Case Study.

UNIT – IV : MINING DATA STREAMS **(9 Periods)**

The stream data model – Sampling data streams – counting distinct elements in a stream – Estimating moments. Finding similar items – Applications of nearest neighbor search – shingling of documents - similarity preservation – locality sensitive hashing- distance measures – methods for high degree similarity.

UNIT – V : LINK ANALYSIS AND FREQUENT ITEMSETS **(9 Periods)**

Link analysis – Page rank – Efficient computation of a page rank – topic sensitive page rank – link spam –Frequent datasets – the market basket model – Apriori algorithm – handling larger datasets in main memory –limited pass algorithm – counting frequent items in a stream.

Contact Periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOKS:

1. *Thomas Erl, WajidKhattak, and Paul Buhler**, "Big Data Fundamentals Concepts, Drivers & Techniques",** Prentice Hall,2015.*
2. *AnandRajaraman and Jeffrey David Ullman, **"Mining of Massive Datasets",** Cambridge University Press, 2012.*

REFERENCE BOOKS:

1. *Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, **"Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data",** McGraw Hill, 2011.*
2. *Frank J Ohlhorst, **"Big Data Analytics: Turning Big Data into Big Money",** Wiley and SAS Business Series, 2012.*
3. *Bill Franks, **"Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics",** Wiley and SAS Business Series, 2012.*
4. *Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, **"Harness the Power of Big data – The big data platform",** McGraw Hill, 2012.*
5. *Colleen Mccue, **"Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis",** Elsevier, 2007*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to,

CO1: Understand the Big Data and usage in Enterprise Technologies. **[Understand]**
CO2: Store and Process Big Data using suitable Processing Methods. **[Understand]**
CO3: Handle Big Data using appropriate analysis Techniques. **[Analyze]**
CO4: Mine larger data streams using suitable algorithms. **[Understand]**
CO5: Rank pages and handle large data sets efficiently. **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	L	M	L	H	L							M	L
CO2	M				H			L				L	M	L
CO3		H			H							L	M	L
CO4	M	H	M		M							L	M	L
CO5	L	M	H									L	M	L
18IOE $23	**M**	**H**	**M**	**L**	**H**	**L**		**L**				**L**	**M**	**L**

L - Low, M - Moderate (Medium), H - High

18IOE$24	**OBJECT ORIENTED PROGRAMMING USING C++** *(Common to All Branches)*

PRE-REQUISITES: NIL **Category: OE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- Fundamentals of object oriented programming
- Classes and objects
- Concepts of overloading and type conversions
- Inheritance and Polymorphisms
- Files, templates and exception handling

UNIT – I : PRINCIPLES OF OBJECT ORIENTED PROGRAMMING (9 Periods)

Basic concepts- benefits – applications of object oriented programming – beginning with C++ - tokens – expressions and control structures – C++ stream classes – Formatted and Unformatted I/O operations. Managing output with manipulators.

UNIT – II : CLASSES AND OBJECTS (9 Periods)

Introduction – specifying class – defining member functions – memory allocation constructors and destructors - parameterized, copy, default, dynamic and multiple constructors – destructors.

UNIT – III : FUNCTIONS AND TYPE CONVERSIONS (9 Periods)

Introduction – function prototyping call by reference – return by reference – inline function – recursion – friend function – function overloading – operator overloading – manipulation of strings using operators – type conversions.

UNIT – IV : INHERITANCE AND POLYMORPHISM (9 Periods)

Defining derived classes – single, multiple, multilevel, hierarchical and hybrid inheritance – virtual base classes – abstract base classes – nesting of classes - pointers – pointers to objects – this pointer – pointers to derived classes – virtual functions – pure virtual functions virtual constructors and destructors.

UNIT – V : FILES AND TEMPLATES (9 Periods)

Classes for file stream operations – opening and closing a file – detecting EOF – open file modes – file pointers and their manipulations – sequential I/O operations – updating and error handling of file. Class and function template – template with multiple parameters – overloading, member function and non-type template arguments-Exception handling.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. *Lafort Robert,* ***"Object oriented profframming in C++",*** *4th Edition.*
2. *E.Balagurusamy,* ***"Object oriented Programming with C++",*** *McGraw Hill Education Ltd, 7th Edition 2017.*

REFERENCE BOOKS:

1. *R.Rajaram,* ***"Object Oriented Programming and C++",*** *New Age International 2nd edition, 2013.*
2. *K.R. Venugopal, Rajkumar, T. Ravishankar,* ***"Mastering C++",*** *Tata McGraw Hill Education, 2nd edition, 2013.*
3. *Yashavant P. Kanetkar,* ***"Let us C++",*** *BPB Publications, 2nd edition 2003.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to,

CO1: Understand the principles of object oriented programming. **[Understand]**
CO2: Develop programs using classes and objects. **[Analyze]**
CO3: Use functions and type conversions in programs. **[Understand]**
CO4: Apply inheritance and polymorphism to develop applications. **[Analyze]**
CO5: Use files, templates and handle exceptions. **[Understand]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	H	H	M			M						M	L
CO2	M	H	H	H			M						H	L
CO3	M	H	H	H			M						H	L
CO4	M	H	H	H			M						H	L
CO5	M	H	H	H			M						H	L
18IOE $24	M	H	H	H			M						H	L

L - Low, M - Moderate (Medium), H - High

18BOE$25	COMPUTATIONAL BIOLOGY *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand the basic concepts and role of computation in biological analysis
- Familiarize with sequence alignment methods
- Understand the machine learning tools used for biological analysis

UNIT – I : BASICS OF BIOLOGY (9 Periods)

Biomolecules of life: Structure and Composition of DNA, RNA & Protein. Protein Structure basics-Primary, Secondary and tertiary Structure of protein.

UNIT – II : BIOLOGICAL DATABASES (9 Periods)

Concept of Relational database, Data archiving, Data mining, Primary databases-NCBI, EMBL, DDBJ; Structure databases-PDB

UNIT – III : SEQUENCE ANALYSIS (9 Periods)

Pairwise alignment tools-Dot matrix analysis, Dynamic programming-Smith Waterman and Needleman Wunsch algorithm ,Heuristic methods- BLAST,FASTA; Multiple sequence alignment methods-Progressive alignment (Clustal)

UNIT – IV : STRUCTURE ANALYSIS AND DRUG DESIGN (9 Periods)

Protein secondary prediction-Chou fasman method, GOR method; Tertiary structure prediction-Homology modelling, Introduction to Computer aided drug design.

UNIT – V : MACHINE LEARNING (9 Periods)

Genetic Algorithm, Neural networks, Artificial Intelligence, Hidden markov model -application in bioinformatics

Contact Periods:

Lecture: 45 Periods Tutorial: 00 Periods Practical: 00 Periods Total: 45 Periods

TEXT BOOKS:

1. *David W. Mount , **"Bioinformatics: Sequence and Genome Analysis"** , Cold Spring Harbor Laboratory Press, Second Edition, 2004*
2. *Arthur M. Lesk, **"Introduction to Bioinformatics"**, Oxford University Press, 2008.*
3. *Pierre Baldi, Soren Brunak. , **"Bioinformatics: The machine learning approach"**, MIT Press, 2001*

REFERENCE BOOKS:

1. *Andreas D. Baxevanis,* ***"Bioinformatics, A Practical Guide to the Analysis of Genes and Proteins"****, Third edition; Wiley-Interscience, 2004.*
2. *Baxevanis A.D. and Oullette, B.F.,* ***"A Practical Guide to the Analysis of Genes and Proteins"****, 2nd ed., John Wiley, 2002*
3. *David L. Nelson, Michael M. Cox.,* ***"Lehninger: Principles of Biochemistry"****, Sixth edition, Freeman, W. H. & Co. Publisher, 2012.*

COURSE OUTCOMES:

Upon completion of the course the students will be able to

CO1: Understand the basic structure of Biological macromolecules

CO2: Acquire the knowledge of biological databases and its importance.

CO3: Perform pair wise and multiple sequence alignment

CO4: Predict the secondary and tertiary structure of proteins.

CO5: Understand the machine learning approaches in computational biology

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L	L		L			M				L	
CO2	M	L	L	L					L			L	L	L
CO3	L		L			M			L			L	L	
CO4	M	M	L	M	M								M	
CO5		M		H	H	M	L		M				H	H
18BOE $25	M	M	L	M	M	M	L		M			L	M	H

L - Low, M-Moderate (Medium), H- High

18BOE$26	FUNDAMENTAL CONCEPTS OF BIOLOGY FOR ENGINEERS (Common to All Branches)

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic functions of the cell and their mechanisms in transport process.
- To get familiarize human anatomy and physiology.
- To learn about microbes, immune system and biomolecules.
- To know the concepts of applied biology.

UNIT – I : BASICS OF CELL BIOLOGY (9 Periods)

An overview of cells – origin and evolution of cells-cell theory-classification of cells – prokaryotic cells and eukaryotic cells; Structure of prokaryotic and eukaryotic cells and their organelles-comparison of prokaryotic and eukaryotic cells; Transport across membranes – diffusion - active and passive diffusion.

UNIT – II : BASICS OF MICROBIOLOGY (9 Periods)

Classification of microorganism-microscopic examination of microorganisms; Structural organization and multiplication of bacteria-viruses-algae and fungi; Microorganism used for the production of penicillin-alcohol and vitamin B-12.

UNIT – III : HUMAN ANATOMY AND PHYSIOLOGY (9 Periods)

Basics of human anatomy-tissues of the human body-epithelial-connective-nervous and muscular; Nervous system-Respiratory System-Circulatory system and Digestive system.

UNIT – IV : BIO MOLECULES AND IMMUNE SYSTEM (9 Periods)

Introduction to Biochemistry-classification-structure and properties of carbohydrates-proteins- lipids and nucleic acids; Innate and acquired immunity; Types of immune responses.

UNIT – V : APPLIED BIOLOGY FOR ENGINEERS (9 Periods)

Overview of biosensors - glucometer applications-medicine; Microarray analysis to diagnose the cancer; Microbial production of biofuels; Applications of stem cells.

Contact Periods:

Lecture: 45 Periods Tutorial: 00 Periods Practical: 00 Periods Total: 45 Periods

TEXT BOOKS:

1. *Darnell J, Lodish H, Baltimore D.* ***"Molecular Cell Biology"****, W.H.Freeman; 8th Edition, 2016.*
2. *Pelczar MJ, Chan ECS and Krein NR,* ***"Microbiology"****, Tata McGraw Hill, 5thEdition, New Delhi.2001.*
3. *Wulf Cruger and Anneliese Cruger,* ***"A Textbook of Industrial Microbiology"****, Panima Publishing Corporation, 2nd Edition, 2000.*

REFERENCE BOOKS:

1. *David L. Nelson and Michael M Cox, **"Lehninger's Principles of Biochemistry"**, Macmillan Worth Publisher, 4th edition, 2004.*
2. *Brain R.Eggins , **"Chemical Sensors and Biosensors"**, John Wiley & Sons, 2002.*
3. *Anton Moser, **"Bioprocess Technology, Kinetics and Reactors"**, Springer, Berlin (Verlag),1st edition, 1998*
4. *Kuby J, **"Immunology"**, WH Freeman & Co., 7th edition, 2013.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the functions of cell and their structural organization
CO2: Describe the mechanisms and role of cell in immune system
CO3: Get familiarized biomolecules and human anatomy system
CO4: Illustrate the applications of microbes in industrial process
CO5: Apply the engineering concepts in biology

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	L	L	-	-	-	-	-	-	-	-	-	H	M
CO2	L	M	-	L	-	-	L	M	-	-	-	-	M	M
CO3	L	M	L	L	-	-	-	L	M	-	-	L	H	H
CO4	L	L	L	L	M	-	-	-	L	-	-	-	M	H
CO5	-	-	-	-	-	-	-	-	-	-	-	-	H	H
18BOE $26	L	M	L	L	M	-	L	M	M	-	-	L	H	H

L - Low, M-Moderate (Medium), H- High

18BOE$27	**FUNDAMENTALS OF BIOENGINEERING** *(Common to All Branches)*

Category: OE

PRE-REQUISITES: NIL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students aware of the overall industrial bioprocess.
- To understand the basic configuration and parts of a fermentor.
- To study the production of primary and secondary metabolites.
- To understand the production of modern biotechnology products.

UNIT I: INTRODUCTION TO INDUSTRIAL BIOPROCESS (9 Periods)

Fermentation - Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology - A brief survey of organisms, processes, products. Basic concepts of Upstream and Downstream processing in Bioprocess

.

UNIT II : FERMENTATION INDUSTRY (9 Periods)

Overview of fermentation industry, Basic configuration of Fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes. Types of fermentation – Solid state, submerged, batch, continuous, fed batch fermentation methods.

UNIT III : PRODUCTION OF PRIMARY METABOLITES (9 Periods)

A brief outline of processes for the production of some commercially important organic acids - Citric acid, lactic acid ,acetic acid; amino acids - glutamic acid, phenylalanine; ethanol.

UNIT IV: PRODUCTION OF SECONDARY METABOLITES (9 Periods)

Study of production processes for various classes of secondary metabolites: Antibiotics: beta lactams – penicillin and cephalosporin; aminoglycosides – streptomycin; macrolides - erythromycin, vitamin - B9, B12.

UNIT V: PRODUCTS THROUGH MODERN BIOTECHNIQUES (9 Periods)

Production of industrial enzymes - proteases, amylases, lipases; Production of single cell protein from wastes; biopreservatives – Bacterosin; biopolymers - xanthan gum and PHA. Industrial uses of enzymes in detergents, beverage and food.

Contact Periods:

Lecture: 45 Periods Tutorial: 00 Periods Practical: 00 Periods Total: 45 Periods

TEXT BOOKS

1. *Peter F. Stanbur., Stephen J. Hall., A. Whitake., **"Principles of Fermentation Technology"**, Science & Technology Books. 2007.*
2. *Presscott, S.C., Cecil G., Dun, **"Industrial Microbiology"**, Agrobios (India), 2005.*
3. *Casida, L.E., **"Industrial Microbiology"**, New Age International (P) Ltd, 1968.*

REFERENCE BOOK

1. *Crueger, W., Anneliese Cruege.,**"Biotechnology: A Textbook of Industrial Microbiology"**, Panima Publishing Corporation, Edition 2, 2003.*
2. *Sathyanarayana, U., **"Biotechnology"**, Books and Allied (P) Ltd. Kolkata, 2005.*
3. *Ratledge C., Kristiansen B., **"Basic Biotechnology"**, Cambridge University Press, second Edition, 2001.*
4. *Michael J. Waites., **"Industrial Microbiology: An Introduction"**, Blackwell Publishing,2001.*

COURSE OUTCOMES:

Upon completion of the course in Bioprocess Principles graduates will be able to

CO1: Understand the basics of industrial bioprocess.
CO2: Explain the principle of a fermentation process and the chronological development of fermentation industry.
CO3: Understand the basic configuration of a fermentor and its ancillaries.
CO4: Learn the production of various primary and secondary metabolites.
CO5: Understand the production of biotechnological products.

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	H	H	-	-	-	-	-	-	-	-	-	M	-
CO2	H	M	-	-	-	-	-	-	-	-	-	-	-	-
CO3	H	H	H	M	M	M	-	L	H	-	-	-	-	H
CO4	H	L	L	-	-	L	-	L	-	-	-	-	-	H
CO5	H	M	H	L	M	-	-	L	-	-	-	-	-	H
18BOE $27	H	M	H	M	M	M	-	L	H	-	-	-	M	H

L- Low , M-Moderate(Medium), H- High

18CVA$01	SURVEYING USING TOTAL STATION AND AUTOPLOTTER 8

Category : VA

L	T	P	C
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To acquire complete knowledge on Total Station and drafting software.

UNIT – I : INTRODUCTION TO TOTAL STATION (5 Periods)

Introduction to Total Station – Features - operation –advantages - applications in Civil Engineering – capability of a total station – Theory on distance measurement and angle measurement

UNIT – II : PRACTICAL HANDS ON TRAINING FOR TOTAL STATION (5 Periods)

Practical hands on training - Understanding basic key functions and setting up the instrument - Measurement of slope, horizontal and vertical distance measurement - Horizontal angle measurement - Distance and angle measurement of inaccessible/remote points - Three dimensional (3D) Coordinate measurement (X,Y,Z) for preparation of layout maps and contours - Performing area calculation for a given parcel of land.

UNIT – III : PRACTICALHANDS ON TRAINING FOR PROFESSIONAL SOFTWARE (5 Periods)

Hands on training using Autoplotter 8 Professional software - Transfer of collected survey data from Total station to Autoplotter 8 professional software - Preparation of building layout map using the collected coordinate data - Preparation of contour maps and 3D terrain view

Contact Periods: Lecture: 15 Tutorial: 00 Practical: 00 Total: 15 Periods

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Carryout surveying using total station.

CO2: Prepare Building Layout and Contour Maps.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L			H			L	M			H	L		M	H
CO2	M	L	M		H			L	M			H	L		M	H
18CVA $01	M	L	M		H			L	M			H	L		M	H

L- Low , M-Moderate(Medium), H- High

18CVA$02	ENVIRONMENTAL AUDIT

Category : VA

L	T	P	C
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To understand environmental management system concepts, guidelines and requirements of the IS standards.
* To provide a basic understanding of various tools and techniques of, environmental audit.
* To understand the stages of EMS implementation, and environmental - management principles.

UNIT – I : INTRODUCTION (5 Periods)

Preamble – scope and objectives of environmental auditing – applicability of statuary – Environmental statement audit – contents of EIA report – Environmental management system audits as per ISO 19011 – Roles and qualifications of auditors – Environmental performance indicators and their evaluation.

UNIT – II : ENVIRONMENTAL ACT (5 Periods)

Requirements of Rule 14 for Environmental Audit under Environmental protection Act1986 – Importance for industries – Concepts of Consumption Audit – Pollution audit – Hazardous audit – Solid waste audit – Disposal audit – Cost audit – Investment audit – Voluntary audit.

UNIT – III : CASE STUDIES (5 Periods)

Applications of EMS - Waste Audits and Pollution Prevention opportunities in Textile, Sugar, Pulp & Paper, Electroplating, Tanning industry, Dairy, Cement, Chemical industries.

Contact Periods:Lecture: 15 Tutorial: 00 Practical: 00 Total : 15 Periods

REFERENCE BOOKS:

1 *V Murali Krishna and Valli Manickam, "**Environmental Management 1st edition Science and Engineering for Industry"**, Butterworth-Heinemann 2017.*
2 *Christopher S. and Mark Y. (2007) **"Environmental Management Systems, (third edition)"**, Earthscan Publications, First South Asian Edition.*
3 *David L.G. and Stanley B.D. (2001) ISO 14000Environmental Management, Prentice Hall*
4 *Madu C.N. (2007,) **"Environmental Planning and Management"**, Imperial College Press, (Chapters 2, 3, 4, 6, 7, 8, 10).*
5 *Environmental Management in Organizations: The IEMA Handbook John Brady, AlisonEbbage, Ruth Lunn 2011*
6 *ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004*
7 *ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002*
8 *www.tnpcb.gov.in ,www.cpcb.nic.in, www.nptel.ac.in*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Carryout environmental management system audit and outline the role of auditors.

CO2: Express the requirement of environmental audit, various audits for industries and applications of EMS.

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L					H	L				H	L	M		H
CO2	M	L	M				H	L				H	L	M		H
18CVA $02	M	L	M				H	L				H	L	M		H

L- Low , M-Moderate(Medium), H- High

18CVA$03

YOGA FOR YOUTH EMPOWERMENT

(Common to Civil, Mech., EEE & Prodn. Branches)

Category : VA

L	T	P	C
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To create awareness and the benefits of yoga and meditation.
* To study and analyze the influential factors, which affect the engineering students' healthy life.

UNIT – I : PHYSICAL STRUCTURE AND ITS FUNCTIONS (5 Periods)

Yoga - Purpose of life, philosophy of life, Physical structure, Importance of physical exercise, Rules and regulation of simplified physical exercises, hand exercise, leg exercise, breathing exercise, eye exercise, kapalapathy, maharasana, body massage, acupressure, body relaxation

UNIT – II : YOGASANAS (5 Periods)

Rules & Regulations – asana, pranayama, mudra, bandh

UNIT – III : MIND (5 Periods)

Bio magnetism& mind - imprinting & magnifying – eight essential factors of living beings, Mental frequency and ten stages of mind, benefits of meditation, such as perspicacity, magnanimity, receptivity, adaptability, creativity, Simplified Kundalini yoga: Agna, Santhi, thuriam, thuriyatheetham

Contact Periods: Lecture: 15 Tutorial: 00 Practical: 00 Total: 15 Periods

TEXT BOOKS:

1. ***"Yoga for Modern Age"*** *– Vethathiri Maharishi*
2. ***"Mind"*** *– Vethathiri Maharishi*

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Live healthy, Physical, Intellectual & spiritual life.
CO2: Perform various Yogasanas
CO3: Focus concentration to do work effectively

COURSE ARTICULATION MATRIX:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1						L	H	L				H				H
CO2						L	H	L				H				H
18CVA $03						L	H	L				H				H

L- Low , M-Moderate(Medium), H- High