P. A. COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai)
An ISO 9001:2015 Certified Institution - Accredited by NBA and NAAC with 'A' Grade
Pollachi – 642 002

B. E. CIVIL ENGINEERING

CURRICULA & SYLLABI

(I to VIII Semester)

REGULATIONS

2019

Vision and Mission of the Institute and Department

Vision of the Institute

To progress to become a center of excellence in Engineering and Technology through creative and innovative practices in teaching-learning process and promoting research and development to produce globally competitive and employable professionals who are psychologically strong and emotionally balanced with social perception and professional ethics.

Mission of the Institute

To offer academic programmes, in the emerging areas of Engineering and Technology, provide training and research facilities and opportunities to promote student and faculty research in collaboration with Industry and Government for sustainable growth.

Vision of the Department

To produce highly qualified Civil Engineers for the benefit of Nation and World and educate students to meet current and future challenges through excellence in technical education and research.

Mission of the Department

- To develop highly skilled professionals and leaders to the society.
- To provide an effective learning environment where in real time training, problem solving skills, team work, communication and leadership skills are emphasized.
- To maintain an intellectually competitive and collaborative environment which stimulates students and faculty members to achieve their best in profession.

Program Educational Objectives (PEO)

The objectives of the programme are to provide the following to the students:

PEO 1: Analyzing and designing Civil engineering systems with social awareness and responsibility

PEO 2: Exhibiting professionalism and ethics, communication skills, team work through their profession and adopting to emerging technologies

Program Specific Outcomes (PSO):

The following outcomes of the programme are provided to the students:

PSO 1: Applying concepts and solving problems in the branches of Civil Engineering such as Structural, Environmental, Hydraulics, Construction Management and Geotechnical Engineering

PSO 2: Enabling students to understand their role as leaders and attitude process and to be effective in professional practice of Civil Engineering

Program 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 problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze 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 informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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.

SEMESTER I

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
		Induction Programme	0	0	0	0
THEORY						
1	19CABS002	Engineering Chemistry	3	0	0	3
2	19CABS001	Engineering Mathematics - I	3	1	0	4
3	19CAES001	Basics of Electrical Engineering	3	0	0	3
4	19CAES002	Engineering Graphics	2	0	4	4
PRACTICAL						
5	19CABS005	Chemistry Laboratory	0	0	3	1.5
6	19CAES004	Basics of Electrical Engineering Laboratory	0	0	3	1.5
7	19CAES005	Workshop Practice	0	0	4	2
		Total	**11**	**1**	**14**	**19**

SEMESTER II

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19CAHS001	Communicative English	3	0	0	3
2	19CABS007	Engineering Mathematics - II	3	1	0	4
3	19CEBS203	Engineering Physics	3	0	0	3
4	19CAES003	Programming for Problem Solving	3	0	0	3
5	19CAES008	Engineering Mechanics	3	1	0	4
PRACTICAL						
6	19CABS004	Physics Laboratory	0	0	3	1.5
7	19CAES006	Programming in C Laboratory	0	0	3	1.5
		Total	**15**	**2**	**6**	**20**

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19CABS008	Transforms and Partial Differential Equations	3	0	0	3
2	19CEPC302	Strength of Materials - I	3	0	0	3
3	19CEES303	Construction Materials and Technology	3	0	0	3
4	19CEPC304	Mechanics of Fluids	3	0	0	3
5	19CEPC305	Surveying	3	0	0	3
6	19CEBS306	Engineering Geology	3	0	0	3
7	19CAMC001	Constitution of India	3	0	0	0
PRACTICAL						
8	19CEPC308	Survey Laboratory	0	0	3	1.5
9	19CEEE309	Computer Aided Civil Engineering Drawing	0	0	3	1.5
		Total	**21**	**0**	**6**	**21**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19CABS009	Numerical Methods	3	0	0	3
2	19CEPC402	Strength of Materials - II	3	0	0	3
3	19CEPC403	Water Supply Engineering	3	0	0	3
4	19CEPC404	Applied Hydraulics and Fluid Machinery	3	0	0	3
5	19CEPC405	Mechanics of Soils	3	0	0	3
6	19CAHS002	Environmental Science and Engineering	3	0	0	3
PRACTICAL						
7	19CEPC407	Fluid Mechanics and Machinery Laboratory	0	0	3	1.5
8	19CEPC408	Materials Testing Laboratory	0	0	3	1.5
		Total	**18**	**0**	**6**	**21**

SEMESTER V

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19CEPC501	Structural Analysis - I	3	0	0	3
2	19CEPC502	Highway and Railway Engineering	3	0	0	3
3	19CEPC503	Basic Structural Design - I (Steel)	3	0	0	3
4	19CEPC504	Wastewater Engineering	3	0	0	3
5	19CEPE5XX	Professional Elective - I	3	0	0	3
6		Open Elective - I	3	0	0	3
PRACTICAL						
7	19CEPC507	Geotechnical Engineering Laboratory	0	0	3	1.5
8	19CEPC508	Environmental Engineering Laboratory	0	0	3	1.5
9	19CAHS003	Communication Skills Laboratory	0	0	2	1
10	19CEEE510	In plant Training - I (3 Weeks During IV Semester Vacation)	0	0	0	0
		Total	**18**	**0**	**8**	**22**

SEMESTER VI

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19CEPC601	Structural Analysis - II	3	0	0	3
2	19CEPC602	Foundation Engineering	3	0	0	3
3	19CEPC603	Basic Structural Design - II (Concrete)	3	0	0	3
4	19CEPC604	Irrigation Engineering	3	0	0	3
5	19CEPE6XX	Professional Elective - II	3	0	0	3
6		Open Elective - II	3	0	0	3
PRACTICAL						
7	19CEPC607	Concrete and Highway Engineering Laboratory	0	0	3	1.5
8	19CEEE608	Irrigation and Environmental Engineering Drawing	0	0	3	1.5
9	19CEEE609	Survey Camp (2 Weeks During V Semester Vacation)	0	0	0	2
		Total	**18**	**0**	**6**	**23**

SEMESTER VII

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19CEPC701	Pre-stressed Concrete Structures	3	0	0	3
2	19CEPC702	Estimation, Costing and Valuation Engineering	3	0	0	3
3	19CEPE7XX	Professional Elective - III	3	0	0	3
4	19CEPE7XX	Professional Elective - IV	3	0	0	3
5		Open Elective - III	3	0	0	3
PRACTICAL						
6	19CEPC706	Structural Design and Drawing	0	0	4	2
7	19CEEE707	Mini Project	0	0	4	2
8	19CEEE708	Inplant Training - II (3 Weeks During VI Semester Vacation)	0	0	0	0
		Total	**15**	**0**	**8**	**19**

SEMESTER VIII

Sl. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19CEPE8XX	Professional Elective - V	3	0	0	3
2	19CEPE8XX	Professional Elective - VI	3	0	0	3
3		Open Elective - IV	3	0	0	3
PRACTICAL						
4	19CEEE804	Project Work	0	0	16	8
5	19CEEE805	Internship (Minimum 4 Weeks During VII Semester Vacation)	0	0	0	0
		Total	**9**	**0**	**16**	**17**

TOTAL NO. OF CREDITS: 162

HUMANITIES AND SOCIAL SCIENCES (HS)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CAHS001	Communicative English	3	0	0	3
2	19CAHS002	Environmental Science and Engineering	3	0	0	3
3	19CAHS003	Communication Skills Laboratory	0	0	2	1

BASIC SCIENCES (BS)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CABS002	Engineering Chemistry	3	0	0	3
2	19CABS001	Engineering Mathematics - I	3	1	0	4
3	19CABS005	Chemistry Laboratory	0	0	3	1.5
4	19CABS007	Engineering Mathematics - II	3	1	0	4
5	19CEBS203	Engineering Physics	3	0	0	3
6	19CABS004	Physics Laboratory	0	0	3	1.5
7	19CABS008	Transforms and Partial Differential Equations	3	1	0	4
8	19CEBS306	Engineering Geology	3	0	0	3
9	19CABS009	Numerical Methods	3	0	0	3

ENGINEERING SCIENCES (ES)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CAES001	Basics of Electrical Engineering	3	0	0	3
2	19CAES002	Engineering Graphics	2	0	4	4
3	19CAES004	Basics of Electrical Engineering Laboratory	0	0	3	1.5
4	19CAES005	Workshop Practice	0	0	4	2
5	19CAES003	Programming for Problem Solving	3	0	0	3
6	19CAES008	Engineering Mechanics	3	1	0	4
7	19CAES006	Programming in C Laboratory	0	0	3	1.5
8	19CEES303	Construction Materials and Technology	3	0	0	3

PROFESSIONAL CORE (PC)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CEPC302	Strength of Materials - I	3	0	0	3
2	19CEPC304	Mechanics of Fluids	3	0	0	3
3	19CEPC305	Surveying	3	0	0	3
4	19CEPC308	Survey Laboratory	0	0	3	1.5
5	19CEPC402	Strength of Materials - II	3	0	0	3
6	19CEPC403	Water Supply Engineering	3	0	0	3
7	19CEPC404	Applied Hydraulics and Fluid Machinery	3	0	0	3
8	19CEPC405	Mechanics of Soils	3	0	0	3
9	19CEPC407	Fluid Mechanics and Machinery Laboratory	0	0	3	1.5
10	19CEPC408	Materials Testing Laboratory	0	0	3	1.5
11	19CEPC501	Structural Analysis - I	3	0	0	3
12	19CEPC502	Highway and Railway Engineering	3	0	0	3
13	19CEPC503	Basic Structural Design - I (Steel)	3	0	0	3
14	19CEPC504	Waste Water Engineering	3	0	0	3
15	19CEPC507	Geotechnical Engineering Laboratory	0	0	3	1.5
16	19CEPC508	Environmental Engineering Laboratory	0	0	3	1.5
17	19CEPC601	Structural Analysis - II	3	0	0	3
18	19CEPC602	Foundation Engineering	3	0	0	3
19	19CEPC603	Basic Structural Design - II (Concrete)	3	0	0	3
20	19CEPC604	Irrigation Engineering	3	0	0	3
21	19CEPC607	Concrete and Highway Engineering Laboratory	0	0	3	1.5
22	19CEPC701	Pre-stressed Concrete Structures	3	0	0	3
23	19CEPC702	Engineering Economics, Estimation and Costing	3	0	0	3
24	19CEPC707	Structural Design and Drawing	0	0	4	2

PROFESSIONAL ELECTIVES (PE) - I (SEMESTER V)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CEPE501	Pavement Engineering	3	0	0	3
2	19CEPE502	Concrete Technology	3	0	0	3
3	19CEPE503	Water Resources Engineering	3	0	0	3
4	19CEPE504	Hydraulic Structures	3	0	0	3

PROFESSIONAL ELECTIVES (PE) - II (SEMESTER VI)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CEPE601	Steel Structures	3	0	0	3
2	19CEPE602	Fundamentals of Remote Sensing and GIS Applications	3	0	0	3
3	19CEPE603	Construction Management	3	0	0	3
4	19CEPE604	Hydrology	3	0	0	3

PROFESSIONAL ELECTIVES (PE) - III (SEMESTER VII)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CEPE701	Concrete Structures	3	0	0	3
2	19CAHS004	Professional Ethics in Engineering	3	0	0	3
3	19CEPE703	Earthquake Engineering	3	0	0	3
4	19CEPE704	Traffic Engineering and Management	3	0	0	3

PROFESSIONAL ELECTIVES (PE) - IV (SEMESTER VII)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CEPE705	Advanced Concrete Design	3	0	0	3
2	19CEPE706	Basics of Dynamics and Aseismic Design of Structures	3	0	0	3
3	19CEPE707	Finite Element Method	3	0	0	3
4	19CEPE708	Airport, Docks and Harbour Engineering	3	0	0	3

PROFESSIONAL ELECTIVES (PE) - V (SEMESTER VIII)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CEPE801	Safety in Civil Engineering Practices	3	0	0	3
2	19CEPE802	Prefabricated Structures	3	0	0	3
3	19CEPE803	Ground Improvement Techniques	3	0	0	3
4	19CEPE804	Bridge Engineering	3	0	0	3

PROFESSIONAL ELECTIVES (PE) - VI (SEMESTER VIII)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CEPE805	Maintenance and Rehabilitation of Structures	3	0	0	3
2	19CEPE806	Environmental Legislations in India	3	0	0	3
3	19CEPE807	Industrial Wastewater Management	3	0	0	3
4	19CEPE808	Sustainable Engineering and Technology	3	0	0	3

OPEN ELECTIVES (OE)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CAOE01	Geographical Information System	3	0	0	3
2	19CAOE02	Green Buildings	3	0	0	3
3	19CAOE03	Planning of Smart Cities	3	0	0	3
4	19CAOE04	Vastu Science for Building Construction	3	0	0	3
5	19CAOE05	Disaster Management and Mitigation	3	0	0	3
6	19CAOE06	Open Source Technologies	3	0	0	3
7	19CAOE07	Ethical Hacking	3	0	0	3
8	19CAOE08	Internet of Things	3	0	0	3
9	19CAOE09	Software Testing	3	0	0	3
10	19CAOE10	User Interface Design	3	0	0	3
11	19CAOE11	Automotive Electronics	3	0	0	3
12	19CAOE12	Hardware Descriptive Language	3	0	0	3
13	19CAOE13	Embedded System Design using ARM Processor	3	0	0	3
14	19CAOE14	Bioinspired Computing Technologies	3	0	0	3
15	19CAOE15	Vehicular Communication and Networking Technology	3	0	0	3

16	19CAOE16	Energy Efficient Lighting System	3	0	0	3
17	19CAOE17	Sensors and Transducers	3	0	0	3
18	19CAOE18	Electrical Safety	3	0	0	3
19	19CAOE19	Electric Vehicles	3	0	0	3
20	19CAOE20	SCADA System and Application Management	3	0	0	3
21	19CAOE21	Testing of Materials	3	0	0	3
22	19CAOE22	Robotics	3	0	0	3
23	19CAOE23	Industrial Engineering	3	0	0	3
24	19CAOE24	Marketing Management	3	0	0	3
25	19CAOE25	Energy Conservation and Management	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EE)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CEEE309	Computer Aided Civil Engineering Drawing	0	0	3	1.5
2	19CEEE510	3 Week In Plant Training During Summer Semester Vacation	0	0	0	0
3	19CEEE608	Irrigation and Environmental Engineering Drawing	0	0	3	1.5
4	19CEEE609	Survey Camp (During winter semester vacation)	0	0	0	1
5	19CEEE707	Mini Project	0	0	4	2
6	19CEEE708	3 Week In Plant Training During Summer Semester Vacation	0	0	0	0
7	19CEEE804	Project Work	0	0	16	8
8	19CEEE805	Internship for a period of minimum 4 weeks during winter semester vacation	0	0	0	0

MANDATORY COURSE (MC)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CAMC001	Constitution of India	3	0	0	0

VALUE ADDED COURSES (VA)

SI. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	19CEVA$01	Surveying using Total Station	5	0	10	1
2	19CEVA$02	Environmental Audit	10	0	5	1
3	19CEVA$03	Yoga for Youth empowerment	5	0	10	1
4	19CEVA$04	Valuation	10	0	5	1
5	19CEVA$05	Design of Multi Storey Building	15	0	0	1
6	19CEVA$06	Civil Engineering – Societal and Global impact	15	0	0	1

SUMMARY OF CREDIT DISTRIBUTION

SI. No.	Course Work Subject Area	Credits Per Semester								Total Credits	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	HS	-	3	-	3	1	-	-	-	7	4.32
2	BS	8.5	8.5	6	3	-	-	-	-	26	16.05
3	ES	10.5	8.5	3	-	-	-	-	-	22	13.58
4	PC	-	-	10.5	15	15	13.5	8	-	62	38.27
5	PE	-	-	-	-	3	3	6	6	18	11.11
7	EE	-	-	1.5	-	-	3.5	2	8	15	9.26
6	OE	-	-	-	-	3	3	3	3	12	7.41
8	MC	-	-	-	-	-	-	-	-	-	-
9	VA	-	-	-	-	-	-	-	-	-	-
	Total	19	20	21	21	22	23	19	17	162	100

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

INDUCTION PROGRAMME **SEMESTER I**

Number of Days **21 Days**

Activities:

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

19CABS002 ENGINEERING CHEMISTRY SEMESTER I

L T P C

3 0 0 3

COURSE OBJECTIVES:

- The student should be conversant with water characterization, boiler feed water requirements, related problems and water treatment techniques.
- To acquaint the student with concepts of important photo physical and photochemical processes and elemental analysis using spectroscopy.
- To obtain the knowledge on types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- To make the student understand the preparation, properties and applications of engineering materials.
- To accustom the students about the principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.

UNIT-I: WATER TECHNOLOGY 9

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

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

UNIT-III: FUELS AND COMBUSTION 9

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

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

UNIT-V: CORROSION 9

Corrosion - Spontaneity - Chemical corrosion - mechanism, nature of oxides - Pilling Bed

worth 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: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Jain. P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publications Pvt. Ltd, New Delhi, 16" Edition, 2017.
2. Vairam.S, Subha Ramesh, "Engineering Chemistry", Wiley India, 2015.
3. Dara. S. S, Umarae, "Text book of Engineering Chemistry", S. Chand Publications, 2004.
4. Agarwal, C.V. "Chemistry of Engineering Materials", 9" Edition, B.S. Publications, 2006.
5. Kuriakose, J.C., and Rajaram J, "Chemistry in Engineering and Technology", Vol.1 & II, Tata McGraw Hill Publishing company Pvt. Ltd, New Delhi, 2001.
6. Sharma Y.R,"Elementary Organic Spectroscopy", S. Chand Publications, 2013.

COURSE OUTCOMES:

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

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

CO2: Achieve advanced knowledge about the interaction of electromagnetic radiation with matter and their applications for elemental analysis determination.

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

CO4: Familiar with 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 on corrosion of the machinery and also to understand the mechanisms to adopt the preventive measures by various techniques.

19CABS001 ENGINEERING MATHEMATICS - I SEMESTER I

L T P C
3 1 0 4

COURSE OBJECTIVES:

- To be familiarize with differentiation of single variable and its applications.
- To acquire knowledge of differentiation for more than one variable and its applications.
- To obtain the knowledge of definite and improper integration.
- To acquire the knowledge of multiple integration and related applications.
- To gain methods to solve differential equations with constant and variable coefficients.

UNIT-I: DIFFERENTIAL CALCULUS 9+3

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT -II: FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial differentiation - Homogeneous functions and Euler's theorem - Total derivative - Change of variables - Jacobians - Partial differentiation of implicit functions - Taylor's series for functions of two variables - Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers.

UNIT-III: INTEGRAL CALCULUS 9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT-IV: MULTIPLE INTEGRALS 9+3

Double integrals - Change of order of integration - Double integrals in polar coordinates - Area enclosed by plane curves - Triple integrals - Volume of solids - Change of variables in double and triple integrals.

UNIT-V: DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients - Method of variation of parameters - Homogenous equation of Euler's and Legendre's type - System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

Contact periods:

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

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publisher, 43rd Edition, 2010.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
3. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
5. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.

6. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.

COURSE OUTCOMES:

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

CO1: Understand the limit definition and rules of differentiation to differentiate functions

CO2: Apply differentiation to solve maxima and minima problems

CO3: Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts

CO4: Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables

CO5: Apply various techniques in solving differential equations

19CAES001 BASICS OF ELECTRICAL ENGINEERING SEMESTER I

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand and analyze basic electric circuits.
- To study working principles of Electrical Machines and Transformers.
- To study working principles of power converters and Drives.

UNIT-I: DC CIRCUITS 9

Electrical Circuits Elements - Voltage and Current Sources - Source transformation Techniques - Ohm's Law, Kirchhoff's Laws - Analysis of simple circuits with DC Excitation - Superposition, The venin and Norton's Theorem. Star and Delta Transformation. Time Domain analysis of first order RL and RC circuits.

UNIT-II: AC CIRCUITS 9

Representation of sinusoidal waveforms, peak, RMS and average value. Real power, Reactive power, Apparent power and Power factor. Analysis of single phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel) - Resonance in series circuits(study of phenomenon). Three phase circuits - Relation between voltage and current in star and delta connections - Three phase balanced circuits.

UNIT-III: DC MACHINES AND TRANSFORMERS 9

Construction and Principle of operation and speed control of separately excited DC motor - Characteristics of Motor - Applications - Magnetic Materials - BH Characteristics - Single Phase Transformer - Equivalent Circuit - Types of Losses in a Transformer - No Load test and load test - Regulation and Efficiency - Auto transformer - Three Phase Transformer Connections - use of Transformers - Applications.

UNIT-IV: AC MACHINES 9

Construction and Principle of operation of Three phase Induction Motor - Torque slip Characteristics - Starting and Speed Control Methods - Loss component and Efficiency. Construction and Working Principle of single phase Induction Motor. Construction and Working of Synchronous generators and types - Applications of all Machines.

UNIT-V: POWER CONVERTERS AND DRIVES 9

Operation of three phase converter and inverter circuits - Working of chopper and duty ratio control - Chopper control of separately excited DC motor - Stator voltage control of Three phase Induction Motor drives - Rotor resistance control of Three phase Induction motor - Closed loop control of slip power recovery scheme.

Contact Periods:

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

REFERENCES:

1. Kothari. D.P and Nagrath I.J., "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. Bimbra P.S., "Electrical Machinery", Khanna Publishers, 2011.
3. M.H. Rashid.M.H., "Power Electronics: circuits, Devices and Applications", Pearson Education India, 2009.

4. Dubey. G.K., “Power Semiconductor controlled Drives”, Prentice Hall, 1989.
5. Nagsarkar.T K and Sukhija. M.S., “Basic Electrical Engineering”, Oxford Press, 2005.
6. INagrath.I.J and Kothari. D.P., “Electric Machines”, McGraw Hill Education, 2010.

COURSE OUTCOMES:

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

CO1: Verify Ohm’s law and Kirchhoff’s Law for simple Electrical Circuits

CO2: Verify simple Network Theorems for Electrical Circuits

CO3: Solve Problems on AC Circuits and Analyze three phase AC circuits

CO4: Understand the performance of DC Machines and Transformers

CO5: Basic Understanding of Power Electronics Circuits and their application in speed control of AC and DC Machine

19CAES002 ENGINEERING GRAPHICS SEMESTER I

L T P C
2 0 4 4

COURSE OBJECTIVES:

- To know the geometrical construction in plane geometry and to draw various curves used in engineering practice
- To know how to draw orthographic projection from a pictorial view of a solid
- To practice the projection of points based on quadrants, line and planes in first quadrant
- To know about solid and its projection and its sectional views on different principle planes
- To know development of various solid surfaces and to draw isometric projection from available principle plane projections

UNIT-I: GEOMETRICAL CONSTRUCTIONS 6+12

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. Curves used in engineering practices: Conics. Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloids - construction of involutes of square and circle. Drawing of tangents and normal to the above curves.

UNIT-II: ORTHOGRAPHIC PROJECTIONS AND SCALES 6+12

Orthographic projection - Principles - Principal planes - First angle projection - Visualization: concepts and principles - Representation of Three Dimensional objects - Layout of views- Sketching of multiple views from pictorial views of objects - Scales: Construction of Diagonal and Vernier scales.

UNIT-III: PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

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

UNIT-IV: PROJECTION OF SOLIDS AND SECTION OF SOLIDS 6+12

Projection of simple solids like prisms, pyramids, cylinder, and cone when the axis is inclined to one of the principal planes by rotating object method and freely suspended solids. Sectioning of simple solids like prisms, pyramids, cylinder, and cone in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - Obtaining true shape of section.

UNIT-V: DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTION 6+12

Development of lateral surfaces of simple and sectioned solids - Prisms, Pyramids, cylinder and cone. Principles of isometric projection - isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinder, cone - combination of two solid objects in simple vertical positions.

COMPUTER AIDED DRAFTING (Demonstration Only)

Introduction to computer aided drafting package to make 2-D Drawing. Object Construction -

Page layout - Layer and Line type - Creating, Editing and selecting the Geometric Objects - 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.

Contact Periods:

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

REFERENCES:

1. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, NewDelhi, 2015.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
3. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P)Limited, 2008.
5. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
6. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.

COURSE OUTCOMES:

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

CO1: Familiarize with the fundamentals and standards of Engineering graphics

CO2: Perform freehand sketching of basic geometrical constructions and multiple views of objects

CO3: Project orthographic projections of lines and plane surfaces

CO4: Draw projections and solids and section of solids

CO5: Visualize and development the solid surfaces and projects the isometric views

19CABS005 CHEMISTRY LABORATORY SEMESTER I

L T P C

0 0 3 1.5

COURSE OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis.
- To provide exposure to the students with hands on experience on the determination of chemical substances present in solution by conductometric and potentiometric experiments.
- To quantify the Copper content by Iodometric method.
- To expose the students to test the Saponification value of an oil.
- To equip the students with the principles of rate constant of a chemical reaction.

LIST OF EXPERIMENTS:

1. Estimation of hardness by EDTA method.
2. Estimation of chloride by Argentometric method.
3. Conductometric titration of mixture of acids and strong base.
4. Estimation of iron content of the given solution using Potentiometer.
5. Determination of Saponification value of 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 by Iodometry.
10. Conductometric titration of strong acid and strong base.
11. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
12. Estimation of copper content of the given solution by Iodometry.

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

CO2: Apply the EMF and conductometric measurements in quantitative analysis of Substances.

CO3: Equip with the methods and techniques involved in the Saponification process.

CO4: Comprehend the rate constant of a chemical reaction with respect to time.

CO5: Quantify the metal ion concentration of the given sample.

19CAES004 BASICS OF ELECTRICAL ENGINEERING LABORATORY **SEMESTER I**

L T P C
0 0 3 1.5

COURSE OBJECTIVES:

- To familiarize with basic electrical wiring and Measurements.
- To provide basic laboratory experience on Electronic circuits, DC Machines, AC Machines and Transformers.
- To demonstrate internal cut-section view of machines and other advanced measurement devices.

LIST OF EXPERIMENTS

1. Introduction to measuring instruments - Voltmeter, Ammeter, Wattmeter, Multimeter and Digital storage oscilloscope
2. Verification of Laws in Electrical Circuits
3. Measurement of phase difference between voltage and current
4. No load test on single phase transformer and equivalent test
5. Load test on single phase transformer
6. Three phase transformer connections
7. Voltage- Current relations in three phase circuit and three phase power measurement
8. Demonstration of cut out section of machines
9. Swinburne's test, speed control and load test on DC motor
10. Direction change and load test on three phase induction motor
11. Alternator load test and regulation test
12. Demonstration of LT switchgear components
13. Demonstration of AC and DC drives

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: Making Electrical connections by wires of appropriate wires.
CO2: Acquire exposure to common Electrical Components and Measuring Instruments.
CO3: Verify simple laws using Electrical Circuits.
CO4: Do experiment to understand the characteristics of Transformers and Electrical Machines.
CO5: Understand the working of low tension switch gear components, AC and DC drives.

19CAES005 WORKSHOP PRACTICE SEMESTER II

L T P C
0 0 4 2

COURSE OBJECTIVES:

- To provide exposure to the students with hands on various basic engineering practices in Civil, Mechanical and Electrical Engineering.
- To make various basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail joint, Mortise & Tenon and Cross-Lap joint.
- To make various Welding joints and sand mould preparation for various patterns.
- To prepare electrical wirings.
- To fabricate various parts like tray, frustum of cone and square box in sheet metal.

LIST OF EXPERIMENTS

1. Introduction to use of tools and equipments in Carpentry, Welding, Foundry and Sheet Metal
2. Safety aspects in Carpentry, Welding and Foundry
3. Half lap Joint and Dove tail 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: 0 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 60 Periods

COURSE OUTCOMES:

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

CO1: Use a variety of the tools and equipment used in sheet metal, welding, foundries, and carpentry.

CO2: Fabricate basic carpentry prototypes such as the lap joint, lap tee joint, dovetail joint, mortise and Tenon, and cross-lap joint.

CO3: Prepare various Welding joints and sand moulds for various patterns.

CO4: Carry out basic home electrical works and appliances and pipe connections including plumbing woks

CO5: Sheet metal fabrication of various parts such as tray, frustum of cone, and square box

19CAHS001 COMMUNICATIVE ENGLISH SEMESTER II

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make learners acquire listening skills with correct pronunciation, stress and Intonation.
- To emphasize the development of speaking skills amongst the learners of Engineering.
- To inculcate the habit of reading for effective and efficient communication.
- To equip the learners with writing skills needed for academic as well as work place contexts.
- To enable learners to fine-tune their linguistic skills with appropriate grammatical usage.

UNIT-I: LISTENING 9

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

UNIT-II: SPEAKING 9

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 9

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

UNIT-IV: WRITING 9

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

UNIT-V: GRAMMAR AND VOCABULARY 9

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

REFERENCES:

1. Board of Editors, Using English, Orient Black Swan, 2015.
2. Practical English Usage, Michael Swan, OUP 1995.
3. Cambridge BEC Vantage Practice Tests, Self-study Edition, CUP, 2002.
4. Exercises in Spoken English. Parts 1-II, EFLC, Hyderabad, OUP, 2014.
5. Indlish. Jyothi Sanyal, Viva Books, 2006.
6. Communicative English. J. Anbazhagan Vijay, Global Publishers, Chennai 2018.

WEB REFERENCES:

1. www.cambridgeenglish.org/exams/
2. www.examenglish.com/BEC/BEC_Vantage.html
3. www.splendid-speaking.com/exams/bec_ speaking.html

COURSE OUTCOMES:

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

CO1: Listen and comprehend the contexts delivered in English

CO2: Speak clearly, confidently, comprehensively and communicate with one or many listeners using appropriate communicative strategies

CO3: Read different genres of texts adopting various reading strategies

CO4: Write effectively and persuasively to enhance students' employability

CO5: Communicate cohesively, coherently and flawlessly avoiding grammatical errors and using a wide vocabulary range in speaking and writing contexts

19CABS007 ENGINEERING MATHEMATICS - II SEMESTER II

L T P C

3 1 0 4

COURSE OBJECTIVES:

- To obtain the knowledge of Eigen values and diagonalization of a matrix.
- To gain the knowledge of vector differentiation, integration and related applications.
- 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 theorem, calculus of residues and complex integration around unit circle and semicircle.
- To be familiar with techniques of Laplace and Inverse Laplace transformation.

UNIT-I: MATRICES 9+3

Eigen values and Eigenvectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigenvectors - Cayley-Hamilton theorem - Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation -Nature of quadratic forms.

UNIT-II: VECTOR CALCULUS 9+3

Gradient and directional derivative -Divergence and curl - Vector identities - Irrotational and Solenoidal vector fields - Line integral over a plane curve - Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems - Verification and application in evaluating line, surface and volume integrals.

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UNIT-III:ANALYTIC FUNCTIONS 9+3

Analytic functions - Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties -Harmonic conjugates - Construction of analytic function - Conformal mapping - Mapping by functions $w= z + c$, cz ,$\frac{1}{z}$, z^2 - Bilinear transformation.

UNIT-IV: COMPLEX INTEGRATION 9+3

Line integral - Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's series - Singularities - Residues - Residue theorem - Application of residue theorem for evaluation of real integrals - Use of circular contour and semicircular contour.

UNIT-V: LAPLACE TRANSFORMS 9+3

Existence conditions - Transforms of elementary functions - Transform of unit step function and unit impulse function - Basic properties - Shifting theorems - Transforms of derivatives and integrals - Initial and final value theorems - Inverse transforms - Convolution theorem - Transform of periodic functions - Application to solution of linear second order ordinary differential equations with constant coefficients.

Contact periods:

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

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015.
2. Erwinkreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2016.

3. Bali N.P , Manish Goyal v and Watkins C., "Advanced Engineering Mathematics", Firewall Media, New Delhi, 7th Edition, 2009.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi , 3rd Edition, 2007.
5. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
6. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.

COURSE OUTCOMES:

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

CO1: Understand the concept of Eigen values and eigenvectors, diagonalization of a matrix, symmetric matrices, positive definite matrices and similar matrices

CO2: Acquire knowledge in Gradient, divergence and curl of a vector point function and related identities

CO3: Understand the properties and formation of analytic function, mappings of standard functions and Bilinear transformation

CO4: Understand calculus of residues to evaluate contour integration

CO5: Understand Laplace transform and inverse transform of simple functions, various related theorems and application to differential equations with constant coefficients

19CEBS203 ENGINEERING PHYSICS SEMESTER II

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To acquaint the student about thermal conduction and its applications.
- To know about the basic principles of acoustics, ultrasonic and their industrial applications.
- To accustom the student about origin of quantum physics, Schrodinger's equation and applications.
- To gain knowledge about Emerging materials and their applications.

UNIT-I: MECHANICS OF SOLIDS 9

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 wire - Bending moment - Depression of a cantilever - Young's modulus by Uniform Bending - Non Uniform bending - I shaped girders.

UNIT-II: THERMAL PROPERTIES 9

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

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 ultrasonic - applications- ultrasonic drilling- ultrasonic welding - ultrasonic Non- destructive Testing- Pulse echo system.

UNIT-IV: QUANTUM MECHANICS AND APPLICATIONS 9

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- Schrodinger's Time independent and Time dependent wave equations - Particle in a one dimensional potential well.

UNIT-V: MODERN ENGINEERING MATERIALS 9

Metallic glasses- preparation of metallic glasses - properties - applications of the metallic glasses- Shape Memory Alloys (SMA) - Characteristics, properties of Ni-Ti 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: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Popov. E.P, Engineering Mechanics of Solids, Prentice Hall, 1990.
2. Avadhanulu M. N. and Kshirsagar P. G., A Textbook of Engineering Physics, S.Chand and Company Ltd, New Delhi, 2010.
3. Gaur R.K. and Gupta S.L,Engineering Physics, Dhanpat Rai publishers, 2009.
4. Rajagopal. K, Engineering Physics, PHI Learning Private limited, New Delhi, 2015.
5. S. H. Crandall, N. C. Dahl & T. J. Lardner, An Introduction to the Mechanics of Solids, 2nd Edition with SI Units, McGraw Hill, 2000.
6. Meriam. J. L, Engineering Mechanics: Statics, 7th ed. Wiley, 2012.

COURSE OUTCOMES:

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

CO1: Acquire knowledge in solid mechanics and properties of matter with its applications.

CO2: Acquire knowledge in thermal physics.

CO3: Familiarize on 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.

CO5: Expose the properties and applications of modern engineering materials.

19CAES003 PROGRAMMING FOR PROBLEM SOLVING SEMESTER II

L T P C

3 0 0 3

COURSE OBJECTIVES:

- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop applications in C using functions and pointers.
- To develop program in C using structures and union.
- To perform file handling operations in C and learn dynamically allocated memory techniques.

UNIT-I:BASICS OF C PROGRAMMING 11

Generation and Organization of Computers - Number System - Binary - Decimal - Conversion - Problems. Need for logical analysis and thinking - Algorithm - Pseudo code - Flow Chart. Introduction to programming paradigms: Structure of C program - Data Types - Constants - Enumeration Constants - Keywords - Operators and Expressions - Input / Output statements.

UNIT-II :ARRAYS AND STRINGS 9

Decision making statements - Switch statement - Looping statements - Arrays - Initialization - Declaration - One dimensional and Two dimensional arrays - String: String operations - String Arrays - Simple programs: Sorting - Searching - Matrix operations.

UNIT-III :FUNCTIONS AND POINTERS 9

Introduction to functions: Function prototype, function definition, function declaration, function call, Built-in functions (string functions, math functions) - Recursion - Pointers - Pointer operators - Pointer arithmetic - Arrays and pointers - Array of pointers - Parameter passing: Pass by value, Pass by reference.

UNIT-IV: STRUCTURES AND UNION 9

Structure - Nested structures - Pointer and Structures - Array of structures - Example Program using structures and pointers - Self referential structures - Union - Programs using structures and Unions -Enumeration types - Bit fields -typedefs - Dynamic memory allocation - Storage classes.

UNIT-V: FILE PROCESSING 7

Files: File opening modes - Types of file processing: Sequential access, Random access - Preprocessor directives - Command line arguments.

Contact periods:

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

REFERENCES:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. ReemaTheraja "Fundamentals of Computing and Programming in C", Second Edition, Oxford University Press, 2016.
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 15th revised edition, 2016.

4. Dawn Griffiths, David Griffiths, "Head First C", O'Reilly Publishers, 2012.
5. Paul J.Deitel and Harvey Deitel,"C How to Program", 7th ed.,Pearson Education,2013.

COURSE OUTCOMES:

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

CO1: Develop simple applications in C using basic constructs

CO2: Design and implement applications using arrays and strings

CO3: Develop and implement applications in C using functions and pointers

CO4: Develop applications in C using structures and union

CO5: Design applications using sequential and random-access file processing

19CAES008 ENGINEERING MECHANICS SEMESTER II

L T P C
3 1 0 4

COURSE OBJECTIVES:

- To learn the use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
- To introduce the equilibrium of rigid bodies.
- To study and understand the distributed forces, surface, loading on beam and intensity.
- To develop basic dynamics concepts – force, momentum, work and energy.
- To learn the principles of friction, forces and to apply the concepts of frictional forces at the contact surfaces of various engineering systems.

UNIT-I: STATICS OF PARTICLES 9+3

Introduction - Units and Dimensions - Laws of Mechanics - Lami's theorem, Parallelogram and triangular Law of forces - Vectorial representation of forces - Vector operations of forces - additions, subtraction, dot product, cross product - Coplanar Forces - rectangular components - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility.

UNIT-II: EQUILIBRIUM OF RIGID BODIES 9 + 3

Free body diagram - Types of supports -Action and reaction forces - stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Single equivalent force - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions.

UNIT-III: PROPERTIES OF SURFACES AND SOLIDS 9 + 3

Centroids and centre of mass - Centroids of lines and areas - Rectangular, circular, triangular areas by integration - T section, I section, - Angle section, Hollow section by using standard formula -Theorems of Pappus - Area moments of inertia of plane areas - Rectangular, circular, triangular areas by integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Principal moments of inertia of plane areas - Principal axes of inertia-Mass moment of inertia -mass moment of inertia for prismatic, cylindrical and spherical solids from first principle - Relation to area moments of inertia.

UNIT-IV: DYNAMICS OF PARTICLES 9 + 3

Displacements, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion- Newton's laws of motion - Work Energy Equation- Impulse and Momentum - Impact of elastic bodies.

UNIT-V: FRICTION AND ITS APPLICATIONS 9 + 3

Friction force - Laws of sliding friction - characteristics of dry friction - impending motion- free body diagram for equilibrium analysis of simple systems with sliding friction: ladder, screw, belt and wedge friction - Rolling resistance - Applications.

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

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
3. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
4. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics - Statics and Dynamics", 4th Edition, Pearson Education 2006.
5. Meriam J.L. and Kraige L.G., "Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
6. Rajasekaran S and Sankar Subramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

COURSE OUTCOMES:

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

CO1: Illustrate the vectorial and scalar representation of forces and moments
CO2: Analyse the rigid body in equilibrium
CO3: Evaluate the properties of surfaces and solids
CO4: Calculate dynamic forces exerted in rigid body
CO5: Determine the friction and the effects by the laws of friction

19CABS004 **PHYSICS LABORATORY** **SEMESTER II**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVE:

- To understand the physical and thermal properties of matter.
- To calibrate the electrical devices, Laser diffraction and parameters of optical fibers.
- To determine the compressibility of liquids and viscosity of liquids.
- To analyze the band gap energy of semiconductors and thickness of paper.
- To determine the spectral wavelength and dispersive power of prism.

LIST OF EXPERIMENTS

1. Young's Modulus - Cantilever Bending - Koenig's Method
2. Torsional pendulum - Determination of Rigidity Modulus & Moment of Inertia
3. Young's Modulus - Non Uniform bending Method
4. Lee's Disc method - Thermal conductivity of a bad conductor
5. Ammeter and Voltmeter Calibration - Low Range
6. a) Laser - Particle size Determination
   b) Optical fiber - Determination of NA & Acceptance angle
7. Ultrasonic Interferometer - Velocity of sound & Compressibility of liquids
8. Poiseuille's method - Determination of Coefficient of viscosity of a liquid
9. Determination of Bandgap Energy of Semiconductor
10. Air Wedge - Determination thickness of a paper
11. Spectrometer - Diffraction Grating - Normal Incidence Method
12. Spectrometer - Determination of Dispersive power of a prism

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: Determine the physical and thermal properties of matter

CO2: Calibrate electrical measuring instruments and thereby effectively using it for electronic application and understanding the principle of Laser diffraction and propagation through optical fibers and determine its parameters

CO3: Understand the ultrasonic wave propagation in liquids and determine the viscosity of liquids for engineering applications

CO4: Determine the band gap energy of semiconductor materials and thickness of paper

CO5: Identify the spectral wavelength and determine the dispersive power of prism

19CAES006 PROGRAMMING IN C LABORATORY SEMESTER II

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing.

LIST OF EXPERIMENTS

1. Programs using I/O statements and expressions
2. Programs using decision-making constructs
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number
5. Check whether a given number is Armstrong number or not?
6. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions:
   5 if it is a perfect cube.
   4 if it is a multiple of 4 and divisible by 6.
   3 if it is a prime number.
   Sort the numbers based on the weight in the increasing order as shown below
   <10,its weight>,<36,its weight><89,its weight>
7. Populate an array with height of persons and find how many persons are above the average height
8. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals
9. Given a string - a$bcd./fg‖ find its reverse without changing the position of special characters
   (Example input:a@gh%;j and output:j@hg%;a)
10. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions
11. From a given paragraph perform the following using built-in functions:
    a. Find the total number of words
    b. Capitalize the first word of each sentence
    c. Replace a given word with another word
12. Solve towers of Hanoi using recursion
13. Sort the list of numbers using pass by reference
14. Generate salary slip of employees using structures and pointers.
15. Compute internal marks of students for five different subjects using structures and functions.
16. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
17. Count the number of account holders whose balance is less than the minimum balance using sequential access file
18. **Mini project**
    Create a ―Railway reservation system‖ with the following modules
    - Booking

- Availability checking
- Cancellation
- Prepare chart

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: Develop C programs for simple applications making use of basic constructs, arrays and strings

CO2: Develop C programs involving functions, recursion, pointers, and structures

CO3: Design applications using sequential and random access file processing

19CABS008 **TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS** **SEMESTER III**

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems?
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT-I: PARTIAL DIFFERENTIAL EQUATIONS **9**

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of homogeneous and non– homogeneous types.

UNIT-II: FOURIER SERIES **9**

Dirichlet's conditions General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT- III: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **9**

Classification of PDE – Method of separation of variables – Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT- IV: FOURIER TRANSFORMS **9**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT- V: Z -TRANSFORMS AND DIFFERENCE EQUATIONS **9**

Z -Transforms– Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems – Convolution theorem – Formation of difference equations – Solution of difference equations using Z -transform.

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

REFERENCES :

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S, Manicavachagom Pillay T.K and Ramanaiah.G., "Advanced Mathematics for

Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
3. Andrews L.C and Shivamoggi B., "Integral Transforms for Engineers" SPIE Press, 1999.
4. Bali N.P and Manish Goyal., "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
5. Erwin Kreyszig., "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
6 James G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.

COURSE OUTCOMES:

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

CO1: Understand how to solve the given standard partial differential equations

CO2: Solve differential equations using Fourier series analysis which plays a vital role in engineering applications

CO3: Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations

CO4: Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

CO5: Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

19CEPC302 STRENGTH OF MATERIALS - I SEMESTER III

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamental concepts of Stress, Strain and deformation of solids.
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To understand the effect of torsion on shafts and springs.
- To analyze plane and space trusses.

UNIT- I: STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Simple Stresses and strains – Elastic constants – Relationship between elastic constants – Stress strain diagram – Ultimate stress – Yield stress – Deformation of axially loaded member – Composite bars – Thermal Stresses – State of stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes – Maximum shear stress – Mohr's circle method.

UNIT- II: TRANSFER OF LOADS AND STRESSES IN BEAMS 9

Types of loads, supports, beams – Concept of shearing force and bending moment – Relationship between intensity of load, Shear Force and Bending moment – Shear force and Bending moment diagrams for Cantilever, simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment – Theory of simple bending – Stress Distribution due to bending moment and shearing force – Flitched beams – Leaf springs.

UNIT- III: DEFLECTION OF BEAMS 9

Elastic curve – Governing differential equation – Double integration method – Macaulay's method – Area moment method – Conjugate beam method for computation of slope and deflection of determinant beams.

UNIT-IV: TORSION 9

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

UNIT-V: ANALYSIS OF TRUSSES 9

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

Contact periods:

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

REFERENCES :

1. RajputR.K., "Strength of Materials", S.Chand and Co, New Delhi, 2015.
2. PunmiaB.C., Ashok Kumar Jain and Arun Kumar Jain, "SMTS – I Strength of materials", Laxmi publications. New Delhi, 2015.
3. Junnarkar S.B and Shah H.J., "Mechanics of Structures", Vol I, Charters Publishing

House, New Delhi 2016.
4. Singh D.K., “Strength of Materials”, Ane Books Pvt. Ltd., New Delhi, 2016.
5. Basavarajaiah B.S and Mahadevappa P., “Strength of Materials”, Universities Press, Hyderabad, 2010.
6. Gambhir M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.

COURSE OUTCOMES:

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

CO1: Understand the concepts of stress and strain, principal stresses and principal planes.

CO2: Determine Shear force and bending moment in beams and understand concept of theory of simple bending.

CO3: Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.

CO4: Apply basic equation of torsion in design of circular shafts and helical springs.

CO5: Analyze the pin jointed plane and space trusses.

19CEES303 CONSTRUCTION MATERIALS AND TECHNOLOGY **SEMESTER III**

L	T	P	C
3	0	0	3

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 understand the various types of doors, windows, plastering and paintings.

UNIT-I: STONE, BRICK AND HOLLOW BLOCK MASONRY **9**

Stones – Types– Characteristics – Stone masonry– Classification– Supervision of stone masonry.

Bricks – Composition– Types– Manufacturing**–** 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- II: FLOORING AND ROOFING **9**

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- III: SUB STRUCTURE CONSTRUCTION **9**

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- IV: DOORS, WINDOWS AND PAINTING **9**

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 **9**

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

REFERENCES:

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", Dhanpat Rai Publication Pvt. Ltd., 2010.
3. Edward Allen, Joseph Iano., "Fundamentals of Building Construction: Materials and Methods", Wiley Publishers, 2014.
4. Maden Mehta, "Building Construction", Pearson Education Publishers, 2016.
5. Varghese P.C., "Building Construction", Prentice Hall of India, 2012.
6. Rangwala., "Building construction", Charotar Publishing House Pvt. Ltd., 2016.

COURSE OUTCOMES:

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

CO1: Choose 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: Understand the different construction practices existing in construction field

19CEPC304 **MECHANICS OF FLUIDS** **SEMESTER III**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the 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**

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**

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**

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**

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**

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.

Contact periods:

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

REFERENCES:

1. Kumar D.S., "Fluid Mechanics and Fluid Power Engineering", Kataria S.K& Sons, New Delhi, 2012.
2. Modi P.N. and Seth S.N., "Hydraulics and Fluid Mechanics, Including Hydraulic Machines", Standard Book House, New Delhi, 2015.
3. Kumar K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi,2018.
4. Nagaratnam S., "Fluid Mechanics", Khanna Publishers, New Delhi 1995.

5. Jagdish Lal, “Hydraulics and Fluid Mechanics”, Tata McGraw Hill, New Delhi, 2001.
6. Rajput R.K., “A Text Book of Fluid Mechanics and Hydraulic Machines”, S. Chand And Company, New Delhi, 2015.

COURSE OUTCOMES:

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

CO1: Understand 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: Understand the fluid flow behaviour for laminar and turbulent flows

CO5: Understand the concept of boundary layer separation, drag and lift on immersed bodies

19CEPC305 **SURVEYING** **SEMESTER III**

L	T	P	C
3	0	0	3

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**

Definition – Principles – Classification – Field and office work. 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**

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 **9**

Theodolite – Types – Terms – Temporary and permanent adjustments – Measurement of horizontal angles by repetition and reiteration – Closing error and distribution – Omitted Measurements tachometric 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 tachometry– Subtense bar method.

UNIT-IV:CURVES AND HYDROGRAPHIC SURVEYING **9**

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:MODERN SURVEYING **9**

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 Periods **Tutorial: 0 Periods** **Practical: 0 Period**

REFERENCES:

1. Kanetkar T.P and Kulkarni S.V., "Surveying and Levelling, Vol. I & II", Pune Vidyarthi Griha Prakashan, 2014.
2. DuggalS.K.,"Surveying,Vol.I&II", Tata McGraw–Hill, Publishing Company, 2017.
3. Charles D,Ghilani and Paul R. Wolf., **"**Elementary Surveying", Prentice Hall, 2012.
4. Bannister A., Stanley Raymond and Raymond Baker, "Surveying", Pearson Education.
5. Chandra A.M., "Plane Surveying", New Age International Pvt. Ltd, 2015.

COURSE OUTCOMES:

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

CO1: Calculate distances, angles and levels of various points

CO2: Interpret survey data and compute areas and volumes

CO3: Setting out of curves

CO4: Know about hydro graphic surveying

CO5: Gain knowledge on modern surveying instruments

19CEBS306 ENGINEERING GEOLOGY SEMESTER III

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- 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 harbour as well as to choose types of foundation.
- To imparts knowledge about the methods used to explore the sub surface for natural resources.
- To understand the Engineering significance of the rocks.

UNIT-I:GENERAL GEOLOGY 9

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

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

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

Attitude of beds Dip and Strike – Uses of Clinometers 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

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

REFERENCES:

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. Kesavulu, **"**Text book of Engineering Geology", Macmillan Publishers India Ltd, 2009.
4. Varghese P.C., "Engineering Geology for Civil Engineers", PHI Private Ltd.
5. Roy A.B., "Fundamentals of Geology", Narosa Publication,2010.

COURSE OUTCOMES:

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

CO1: Understand about geological formations of the Earth

CO2: Identify the properties and uses of minerals

CO3: Understand 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

19CAMC001 CONSTITUTION OF INDIA SEMESTER III

L	T	P	C
3	0	0	0

COURSE OBJECTIVES:

- To gain knowledge about Indian constitution.
- To study the growth of modern Indian intellectual's constitutional role.
- To understand the role of socialism in India.
- To be familiar about central and state government functionalities in India.
- To understand about Indian society.

UNIT-I:INTRODUCTION 9

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

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

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

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

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

REFERENCES:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 2018.
2. Agarwal R.C., "Indian Political System", S.Chand and Company, New Delhi, 2004.
3. Laxmikanth M., "Indian Polity", McGraw Hill Education (India) Private limited, 2016.

4. Sharma and Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, New Delhi, 2018.
5. Maciver and Page, “Society: An Introduction Analysis”, Mac Milan India Ltd., New Delhi, 2007.
Sharma K.L., “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi, 2006.

COURSE OUTCOMES:

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

CO1: Realize and abide the rules of the Indian constitution.
CO2: Be aware of the functions of Central Government.
CO3: Illustrate the function of state Government.
CO4: Explain the various constitutional functions.
CO5: Identify different culture among the people of India.

19CEPC308 **SURVEY LABORATORY** **SEMESTER III**

L	T	P	C
0	0	3	1.5

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 &Traversing
3. Levelling – Differential Levelling and Fly Levelling
4. Measurement of horizontal angles by Repetition and Reiteration methods
5. Height and Distance – Single Plane method and Double Plane method
6. Tachometric Surveying – Stadia, Tangential method and Subtense bar method
7. Setting out of Curves
8. Total Station Surveying.(Demonstration only)

Contact periods:

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

COURSE OUTCOMES:

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

CO1: Handle the surveying instruments like Chain, Compass and Dumpy level

CO2: Measure distances, Areas, angles and levels

CO3: Calculate Height of target

CO4: Set out curves

CO5: Handle and measure by the advanced surveying instruments like total station

19CEPC309 COMPUTER AIDED CIVIL ENGINEERING DRAWING **SEMESTER III**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To introduce the students to draft the plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

LIST OF EXPERIMENTS

1. Principles of planning, orientation and complete joinery details (Panelled and Glazed Doors and Windows)
2. Buildings with load bearing walls
3. Buildings with sloping roof
4. R.C.C. framed structures
5. Industrial buildings – North light roof structures
6. Building Information Modelling

Contact periods:

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

REFERENCES:

1. Sikka V.B., "A Course in Civil Engineering Drawing", 4th Edition, S.K.Kataria and Sons, 2015.
2. George Omura, "Mastering in Autocad 2005 and Autocad LT 2005", BPB Publications, 2008.
3. Chuck Eastman, Paul Teicholz, Rafael Sacks and Kathleen Liston, "BIM Handbook:A Guide to Building Information Modelling for Owners, Managers, Designers, Engineers, and Contractors", John Wiley and Sons. Inc., 2011.
4. Marimuthu V.M, Murugesan R and Padmini S., "Civil Engineering Drawing –I", Pratheeba Publishers, 2008.
5. ShahM.G, Kale C.M and PatkiS.Y., "Building Drawing with an Integrated Approach to Build Environment", Tata McGraw Hill Publishers Limited, 2007.
6. VermaB.P., "Civil Engineering Drawing and House Planning", Khanna Publishers, 2010.

COURSE OUTCOMES:

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

- Draw the plan, elevation and sectional views of the buildings, industrial structures, and framed buildings using computer software's.

19CABS009 **NUMERICAL METHODS** **SEMESTER IV**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration this plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT-I:SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS **9**

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Pivoting – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT-II:INTERPOLATION AND APPROXIMATION **9**

Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation – Cubic splines – Difference operators and relations – Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT-III:NUMERICAL DIFFERENTIATION AND INTEGRATION **9**

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT-IV:INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS **9**

Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge – Kutta method for solving first order equations – Multi step methods – Milne's and Adams – Bash forth predictor corrector methods for solving first order equations.

UNIT-V:BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS **9**

Finite difference methods for solving second order two-point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

Contact periods:

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

REFERENCES:

1. Burden R.L and Faires J.D., "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal B.S and Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
3. Brian Bradie., "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
4. Gerald C. F and Wheatley P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
5. Mathews J.H., "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
6. Sankara Rao. K, "Numerical Methods for Scientist and Engineers", Prentice Hall of India Pvt. Ltd., 3rd Edition, New Delhi, 2007.

COURSE OUTCOMES:

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

CO1: Understand the basic concepts and techniques of solving algebraic and Transcendental equations

CO2: Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations

CO3: Apply the numerical techniques of differentiation and integration for engineering problems

CO4: Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations

CO5: Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications

19CEPC402 STRENGTH OF MATERIALS - II SEMESTER IV

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the method of finding slope and deflection of beams and trusses using energy theorems and to know the concept of analysing indeterminate beam.
- To estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material.

UNIT- I:ENERGY PRINCIPLES 9

Strain energy and strain energy density – Strain energy due to axial load (gradual, sudden and impact loadings) , shear, flexure and torsion – Castigliano's theorems – Maxwell's reciprocal theorem – Principle of virtual work – Unit load method – Application of energy theorems for computing deflections in determinate beams , plane frames and plane trusses – Lack of fit and temperature effects – Williot Mohr's Diagram.

UNIT- II:INDETERMINATE BEAMS 9

Concept of Analysis – Propped cantilever and fixed beams – Fixed end moments and reactions – Sinking and rotation of supports – Theorem of three moments – Analysis of continuous beams – Shear force and bending moment diagrams.

UNIT- III:COLUMNS AND CYLINDERS 9

Euler's column theory – Critical load for prismatic columns with different end conditions – Effective length – Limitations – Rankine– Gordon formula – Eccentrically loaded columns – Direct and bending stresses– Middle third rule – Core of a section – Thin cylindrical and spherical shells – Stresses and change in dimensions – Thick cylinders – Compound cylinders – Shrinking on stresses.

UNIT- IV:STATE OF STRESS IN THREE DIMENSIONS 9

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

UNIT- V:ADVANCED TOPICS 9

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre – Curved beams – Winkler Bach formula **–** Stresses in hooks.

Contact periods:

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

REFERENCES:

1. Rajput R.K., "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2015.
2. Rattan S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.
3. Kazimi S.M.A., "Solid Mechanics", Tata McGraw– Hill Publishing Co. New Delhi, 2003.
4. William ANash, "Theory and Problems of Strength of Materials", Schaum's Outline

Series, Tata McGraw Hill Publishing company, 2007.
5. Egor P. Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
6. Singh D.K., "Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2016.

OUTCOMES:

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

CO1: Determine the strain energy and compute the deflection of determinate beams, frames and trusses using energy principles

CO2: Analyze propped cantilever, fixed beam and continuous beams using theorem of three moment equation for external loadings and support settlements

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

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

CO5: Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and find the stresses in curved beams

19CEPC403 WATER SUPPLY ENGINEERING SEMESTER IV

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students conversant with sources and its demand of water.
- To understand 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

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

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

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

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

UNIT-V:DISTRIBUTION OF WATER AND OF WATER SUPPLY 9

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

REFERENCES:

1. Garg S. K., “Water Supply Engineering”, Khanna Publishers, Delhi, 2014.
2. Mark J. Hammer and Mark J. Hammer Jr, “Water and Waste Water Technology”, Prentice hall of India 2008.
3. Mackenzie L. Davis, “Water and Waste Water Engineering Design Principles and

Practice", McGraw Hill book education, 2010.
4. Fair G. M and Geyer J. C., "Water Supply and Waste Water disposal", John Wiley & Sons, 2010.
5. Duggal K.N., "Elements of public Health Engineering", S.Chand and Co, 2007.
6. NPTEL "Water and Waste Water Engineering" by Dr.P.Bose., IIT Kanpur.

COURSE OUTCOMES:

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

CO1: Understand the principles of water supply and characteristics of water
CO2: Attain knowledge on quality of water and its conveyance
CO3: Design various water treatment units
CO4: Get clear knowledge about advanced water treatment
CO5: Understand the distribution and supply of water

19CEPC404 APPLIED HYDRAULICS AND FLUID MACHINERY SEMESTER IV

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand 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 understand the operating principle of positive displacement pumps.

UNIT-I:OPEN CHANNEL FLOW 9

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

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

UNIT-III:MOMENTUM PRINCIPLE 9

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

Turbines – Classification – Impulse and Reaction Turbines – Radial flow turbines – Axial flow turbines – Work done and efficiency – Draft tube and cavitations– Governing and Selection of Turbines – Operating characteristic curves of turbines – Specific speed.

UNIT-V:PUMPS 9

Introduction to Modern pumping machinery – Centrifugal pump – Work done and Efficiency – Minimum speed to start the pump – NPSH (Net positive Suction Head) – Cavitations 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 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Bansal R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 2013.
2. Modi P.N and Seth S. N., "Hydraulics and Fluid Mechanics, Including Hydraulic Machines", Standard Book House, New Delhi, 2015.

3. Subramanya K., “Flow in Open channels”, Tata McGraw– Hill Publishing Company, 2015.
4. Ramamurtham S and Narayanan R., “Hydraulics Fluid Mechanics and Fluid Machines” Dhanpat Rai Publishing Company (P) Limited, 2014.
5. Rajput R.K., “A Text Book of Fluid Mechanics and Hydraulic Machines”, S.Chand and Company, New Delhi, 2015.
6. Ramadurgaiah D., “Fluid Mechanics and Machinery”, New Age International (P) Ltd., 2007.

COURSE OUTCOMES:

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

CO1: Gain insight knowledge on Open channel hydraulics and to solve practical problems

CO2: Understand the concepts of dimensional analysis for fluid flow problems

CO3: Apply the impulse momentum principle for the determination of hydrodynamic forces

CO4: Understand the working principles of different turbines and their performance

CO5: Understand the working principles of different pumps and their Performance

19CEPC405 MECHANICS OF SOILS SEMESTER IV

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge on the basic and engineering properties of soils.
- To get idea about stress distribution due to self– weight of soils and due to externally applied loads.
- To learn flow through soil and to familiarize with the flow net diagrams.
- To understand the Engineering behaviour of soils such as compaction, consolidation and shear strength of soils.

UNIT-I:BASIC PROPERTIES OF SOILS 9

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

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

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

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

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

Contact periods:

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

REFERENCES:

1. Gopal Rajan and Rao A.S.R.,"Basic and Applied Soil Mechanics", New Age International Publishers, 3rd 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", 5thRevised Edition, UBS Publishers' Distributors Ltd., New Delhi, 2001.
4. Braja M.Das, "Textbook of Geotechnical Engineering", Cengage Learning India Private Limited, New Delhi, 2011.
5. Venkataramaiah C., "Geotechnical Engineering" Revised 3rd Edition, New Age International (P) Ltd. Publishers, New Delhi, 2006.
6. Coduto D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt. Ltd., New Delhi, 2002.

COURSE OUTCOMES:

Upon completion of this 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: Understand the soil water system, plot stress distribution diagrams and compute Vertical Stress due to various loading conditions

CO3: Evaluate the permeability and seepage through soils.

CO4: Gain adequate knowledge on the compaction and consolidation characteristics of soils.

CO5: Determine graphically and analytically the shear stresses in any plane.

19CAHS002 ENVIRONMENTAL SCIENCE AND ENGINEERING **SEMESTER IV**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand what constitutes the environment.
- To conserve the natural resources.
- To learn and understand the role of a human being in maintaining a clean and useful environment for the future generations.
- To acquire knowledge about ecological balance and preservation of biodiversity.
- To get an idea about the role of government and non-government organization in environment management.

UNIT-I:ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – Need for public awareness – Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega– Diversity nation – Hot-Spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man– Wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – Pond, river, hill slopes, etc.

UNIT-II:ENVIRONMENTAL POLLUTION 8

Definition –Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: causes, effects and control measures of municipal solid wastes – Role of an individual in prevention of pollution – Pollution Case Studies– Disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT-III:NATURAL RESOURCES 10

Forest resources: Use and over– Exploitation, deforestation, case studies– Timber Extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over– Utilization of Surface and ground water, floods, drought, conflicts over water, dams– Benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer– Pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable

lifestyles. Field study of local area to document environmental assets – River / forest / grassland / hill / mountain.

UNIT-IV:SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – Urban problems related to energy – Water conservation, Rain water harvesting, Watershed management– Resettlement and rehabilitation of people; its problems and concerns, case studies – Role of non–governmental organization– Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – Enforcement machinery involved in environmental legislation– Central and state pollution control boards– Public awareness.

UNIT-V:HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, Variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and chid welfare – Role of information technology in environment and human health – Case studies.

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

REFERENCES:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2004.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt. Ltd., New Delhi, 2007.
4. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt. Ltd., Hydrabad, 2015.
5. Rajagopalan R., "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
6. Tyler Miller G and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt. Ltd., Delhi, 2014.

COURSE OUTCOMES:

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

CO1: Understand how to conserve the natural resources

CO2: Understand what constitutes the environment and how to conserve biodiversity

CO3: Create awareness about environmental pollution and disaster management

CO4: Gain adequate knowledge about the social issues of the environment and the role of government and non-government organization in environment management

CO5: Understand about human population and the environment and the role of information technology in environment and human health

19CEPC407 FLUID MECHANICS AND MACHINERY LABORATORY SEMESTER IV

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To impart knowledge in solving problems occurring in a pipes due to major and minor losses.
- To understand 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. Determination of Meta centric height
8. Performance Study of Rotodynamic pumps: Centrifugal pump, Submersible pump
9. Performance Study of Positive displacement pumps: Reciprocating pump and Gear oil pump
10. Load test on Pelton wheel, Francis turbine and Kaplan Turbines. (Any Two)

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: 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

CO4: Do performance tests on different types of turbines

19CEPC408 MATERIALS TESTING LABORATORY SEMESTER IV

L	T	P	C
0	0	3	1.5

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. Charpy and Izod Impact Test
13. Double shear test

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: 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

19CEPC501 STRUCTURAL ANALYSIS - I SEMESTER V

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To introduce the students to basic theory and concepts of various methods of structural analysis.

UNIT- I: STRAIN ENERGY METHOD 9

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

UNIT- II: SLOPE DEFLECTION METHOD 9

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

UNIT- III: MOMENT DISTRIBUTION METHOD 9

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

UNIT- IV: FLEXIBLITY METHOD 9

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

UNIT- V: STIFFNESS METHOD 9

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

Contact periods:

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

REFERENCES:

1. BhavikattiS.S., “Structural Analysis”, Vol 1&2, Vikas Publishing House Pvt. Ltd,NewDelhi - 4, 2018.
2. Bhavikatti S.S., “Matrix Method of Structural Analysis”, I. K. International Publishing House Pvt. Ltd, New Delhi– 4, 2019.
3. Punmia B.C., Ashok Kumar Jain & Arun Kumar Jain., “Theory of structures”, Laxmi Publications, New Delhi, 2018.
4. Vaidyanathan R., Perumal P. and Abdul Aleem M.I., “Structural Analysis”, Laxmi Publications, New Delhi, 2020.
5. William Weaver and Jrand James M. Gere., “Matrix analysis of framed structures”, CBS Publishers & Distributors, Delhi, 2008.
6. Hibbeler R. C., “Structural Analysis”, VII Edition, Prentice Hall, 2018.

COURSE OUTCOMES:

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

CO1: Analyze continuous beams, pin- jointed indeterminate plane frames and rigid plane frames by strain energy method

CO2: Analyse the continuous beams and rigid frames by slope defection method

CO3: Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway

CO4: Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method

CO5: Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames

19CEPC502 HIGHWAY AND RAILWAY ENGINEERING SEMESTER V

L	T	P	C
3	0	0	3

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

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

Components and their functions – Design principles of flexible and rigid pavements – Factors affecting the design of pavements –Climate, sub grade, 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

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

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

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

REFERENCES:

1. Khanna S.K., C.E.G.Justo and Dr.A.Veeraraghavan, “Highway Engineering”,

Nemchand and Bros, Tenth Edition, 2013.
2. Sharma S.K., "Principles, Practice& Design of Highway Engineering", S.Chand and Co, 2014.
3. Rangwala S.C & K.S., "Railway Engineering", Charotar Publications, 14th Edition, 2008.
4. Subramanian K.P., "Transportation Engineering: Highway Railway Airport & Harbour Engineering", SciTech publications (India) Pvt. Ltd, 2015.
5. Guidelines for the Design of Flexile Pavements, IRC: 37–2018, The Indian roads congress, New Delhi.
6. Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, IRC: 58–2015, the Indian Roads Congress, New Delhi.

COURSE OUTCOMES:

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

CO1: Understand the development, planning & geometric design standards for highways

CO2: Design flexible and rigid pavements

CO3: Comprehend the various desirable properties of highway materials, construction and maintenance of all types of roads

CO4: Get exposed to Railway planning and perform geometric design

CO5: Understand the process of operation and maintenance of railway track

19CEPC503	BASIC STRUCTURAL DESIGN - I (STEEL)	SEMESTER V			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To design the tension and compression steel elements and their connections.
- To understand the behaviour and design of flexural members.
- To familiarize and design the components of industrial buildings.

UNIT- I: SIMPLE STEEL CONNECTIONS **9**

Steel standard sections –Properties – Introduction to Riveted joints – 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.

Eccentric Connections: Eccentric loaded bolted and welded Bracket Connection.

UNIT- II: TENSION MEMBERS **9**

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**

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**

Beams –Permissible bending stress –Section classification – Design of laterally supported and unsupported simply supported beams – Design of built up beams –Curtailment of flange plate-plate girder – Need for lateral support of compression flange and design – Strength of beams in shear.

UNIT- V: ROOF TRUSSES AND INDUSTRIAL BUILDINGS **9**

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 grits using I-sections.

Contact periods:

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

REFERENCES:

1. Duggal S.K., "Limit State Design of Steel Structures", McGraw Hill Education India (P) Ltd, New Delhi, 2019.
2. Subramanian N., "Design of Steel Structures", Oxford University Press, New Delhi, 2016.
3. IS: 800 – 2007, "General Construction in Steel" — Code of Practice.
4. IS 875 – 2015, Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures – Part 3: Wind Loads".
5. Gambhir M.L., "Fundamentals of Structural Steel Design", McGraw Hill Publications

Pvt. Ltd, 2013.
6. PunmiaB. C., Ashok Kumar Jain and Arun kumar Jain, "Design of Steel Structures, Vol. I & II", Laxmi Publications (P) Ltd, 2015.

COURSE OUTCOMES:

Upon completion of this 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: Analyze 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

19CEPC504 WASTEWATER ENGINEERING SEMESTER V

L	T	P	C
3	0	0	3

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: PLANNING AND DESIGN OF SEWERAGE SYSTEM 9

Characteristics and composition of sewage –Population equivalent – Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design – Storm drainage – Storm runoff estimation –Sewer appurtenances –Corrosion in sewers – Prevention and control –Sewage pumping – Drainage in buildings – Plumbing systems for drainage – Rain Water harvesting.

UNIT- II: PRIMARY TREATMENT OF SEWAGE 9

Objectives – Unit Operations and Processes – Selection of treatment processes –Onsite sanitation - Septic tank- Grey water harvesting – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks – Construction, Operation and Maintenance aspects.

UNIT- III: SECONDARY TREATMENT OF SEWAGE 9

Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended aeration systems -Trickling filters– Sequencing Batch Reactor(SBR) – Membrane Bioreactor - UASB – Waste Stabilization Ponds – - Other treatment methods - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects.

UNIT- IV: DISPOSAL OF SEWAGE 9

Standards for Disposal - Methods – dilution – Mass balance principle - Self purification of river- Oxygen sag curve – deoxygenation and reaeration - Streeter–Phelps model - Land disposal – Sewage farming – sodium hazards - Soil dispersion system.

UNIT- V: SLUDGE TREATMENT AND DISPOSAL 9

Objectives - Sludge characterization – Thickening - Design of gravity thickener- Sludge digestion-Standard rate and High rate digester design- Biogas recovery – Sludge Conditioning and Dewatering – Sludge drying beds- ultimate residue disposal – recent advances.

Contact periods:

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

REFERENCES:

1. Metcalf and Eddy “Waste Water Engineering– Treatment and Reuse” Tata Mc–Graw Hill Company, New Delhi 2017.
2. Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2010.
3. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2015.

4. Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi, 2014.

COURSE OUTCOMES:

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

CO1: Attain knowledge on sewage production and house drainage

CO2: Understand Sewerage systems and its design

CO3: Analyse the quality of sewage and design of primary treatments of sewage

CO4: Understand and design the biological treatments of sewage

CO5: Understand the objectives of sludge treatment and disposal

19CEPC507 GEOTECHNICAL ENGINEERING LABORATORY SEMESTER V

L	T	P	C
0	0	3	1.5

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 behavior 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. Tri–axial Compression Test (Demonstration only)

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: Gain adequate knowledge on the physical properties and classify soil based physical properties

CO2: Familiarise with the engineering properties of soil and classify soil based on the engineering properties of soil

CO3: Gain thorough knowledge on the swell characteristics of soils

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

CO5: Acquire the knowledge on handling of field testing equipments

19CEPC508 ENVIRONMENTAL ENGINEERING LABORATORY SEMESTER V

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To understand 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
3. Determination of Turbidity
4. Determination of Chlorides
5. Determination of Total Hardness
6. Determination of Alkalinity and Acidity
7. Determination of Sulphates
8. Estimation of Residual Chlorine
9. 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
10. Determination of Optimum Coagulant Dosage
11. Determination of Dissolved Oxygen
12. Determination of BOD
13. Determination of COD
14. Determination of SVI of Biological sludge and microscopic examination
15. Determination of MPN index of given water sample

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: Understand sampling and preservation methods of water and wastewater
CO2: Test the physical properties of water and waste water
CO3: Test the chemical properties of water and waste water
CO4: Test the biological properties of water and waste water
CO5: Test the Micro–biological properties of water and waste water

19CAHS003 COMMUNICATION SKILLS LABORATORY SEMESTER V

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- To provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing.
- To develop effective communication skills.

UNIT- I **6**

Listening –Listening & answering –Listening to a lecture & pronunciation – **Speaking** – Giving & asking personal information – **Reading** – Strategies for effective reading and Reading comprehension – **Writing** – Develop a paragraph: topic sentence, supporting sentences and concluding sentence – Descriptive paragraph writing.

UNIT- II **6**

Listening – Listening to process information –Stress & intonation patterns – **Speaking** – Small talk – Converse with reasonable accuracy over a wide range of everyday topics – **Reading** – Read for details – Use of graphic organizers to review and aid comprehension – **Writing** – State reasons and examples to support ideas in writing – Write a paragraph with reasons and examples – Opinion paragraph writing.

UNIT- III **6**

Listening– Lexical chunking for accuracy and fluency – Factors influence fluency – Listen for and follow the gist – Listen for details – **Speaking** – Informal talk – Describing health & symptoms – **Reading** – Connectors and Pronouns in a passage – Speed reading techniques – **Writing** – Elements of a good essay – Types of essays –Descriptive, narrative, issue-based, argumentative and analytical.

UNIT- IV **6**

Listening – Active listening – **Speaking** – Giving verbal and non-verbal feedback – Listening & participating in conversations – Strategies for presentations: group/pair presentations – **Reading** – Genre and Organization of Ideas – **Writing** – Email writing – Volumes – Job application – project writing – writing convincing proposals.

UNIT- V **6**

Listening – Listening & responding to explanations in academic & business contexts – Speaking – Participating in a group discussion – **Reading** – Critical reading and thinking – Understanding how the text positions the reader – **Writing**– Statement of Purpose – Letter of recommendation – Vision statement.

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 30 Periods

REFERENCES:

1. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014.
2. Hughes, Glyn and Josephine Moate., Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Davis, Jason and Rhonda Liss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006.
4. Debra Daise, Charl Norloff and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011.
5. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004.
6. Robert M Sherfield and et al. "Developing Soft Skills" 4th edition, New Delhi: Pearson Education, 2009.

COURSE OUTCOMES:

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

CO1: Listen and respond appropriately

CO2: Make effective presentations and participate in group discussions

CO3: Read and evaluate texts critically

CO4: Write winning job applications

CO5: Display critical thinking in various professional contexts

19CEEE510 **INPLANT TRAINING - I** **SEMESTER V**

(3 WEEKS DURING IV SEMESTER VACATION)

L	T	P	C
0	0	0	0

COURSE OBJECTIVE:

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

STRATEGY:

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

COURSE OUTCOMES:

At the end of the course the student will be able to understand

CO1: The intricacies of implementation textbook knowledge into practice

CO2: The concepts of developments and implementation of new technique

19CEPC601 STRUCTURAL ANALYSIS - II SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES :

- To learn the method of drawing influence lines and its uses in various applications like beams and plane trusses.
- To analyse the arches, suspension bridges and space trusses.
- Also to learn Plastic analysis of beams and rigid frames.

UNIT- I: INFLUENCE LINES FOR DETERMINATE BEAMS 9

Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment – Calculation of critical stress resultants due to concentrated and distributed moving loads –Absolute maximum bending moment –Influence lines for member forces in pin jointed plane frames.

UNIT- II: INFLUENCE LINES FOR INDETERMINATE BEAMS 9

Muller Breslau's principle – Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams.

UNIT- III: ARCHES 9

Arches – Types of arches – Analysis of three hinged, two hinged and fixed arches – Parabolic and circular arches – Settlement and temperature effects.

UNIT- IV: CABLES AND SUSPENSION BRIDGES 9

Equilibrium of cable –Length of cable – Anchorage of suspension cables –Stiffening girders – Cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

UNIT- V: PLASTIC ANALYSIS 9

Plastic theory – Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism –Collapse load – Static and kinematic methods – Upper and lower bound theorems – Plastic analysis of indeterminate beams and frames.

Contact periods:

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

REFERENCES:

1. Bhavikatti S.S., "Structural Analysis, Vol.1 & 2", Vikas Publishing House Pvt. Ltd, NewDelhi–4, 2018.
2. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", Laxmi Publications, 2018.
3. Negi L.S and Jangid R.S., "Structural Analysis", Tata McGraw–Hill Publishers, 2004.
4. Reddy C.S., "Basic Structural Analysis", Tata McGraw Hill Publishing Co.Ltd.2002.
5. Vaidyanathan R. and Perumal P., "Structural Analysis", Laxmi Publications, New Delhi, 2018.
6. Gambhir M.L., "Fundamentals of Structural Mechanics and Analysis", PHIL earning Pvt. Ltd, 2011.

OUTCOMES:

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

CO1: Draw influence lines for statically determinate structures and calculate critical stress resultants.

CO2: Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.

CO3: Analyse of three hinged, two hinged and fixed arches.

CO4: Analyse the suspension bridges with stiffening girders.

CO5: Understand the concept of Plastic analysis and the method of analyzing beams and rigid frames.

19CEPC602 FOUNDATION ENGINEERING SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

UNIT- I: SELECTION OF FOUNDATION AND SOIL EXPLORATION 9

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

UNIT- II: BEARING CAPACITY 9

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: FOOTINGS AND RAFTS 9

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum thickness for rigid behaviour – Applications – Compensated foundation – Codal provision.

UNIT- IV: PILE FOUNDATIONS 9

Classification and Selection of piles – Functions – Merits – Load carrying capacity – Static and dynamic formulae – Pile load test – Capacity from penetration test – Pile groups – Efficiency – Field'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 9

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 –Culmann's Graphical construction – Stability analysis of retaining wall – Drainage of backfill.

Contact periods:

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

REFERENCES:

1. Punmia B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition, 2017.

2. Varghese P.C., “Foundation Engineering”, Prentice Hall of India Pvt. Ltd., New Delhi, 2012.
3. Venkatramiah C., “Geotechnical Engineering”, New Age International (P) Ltd. publishers, New Delhi, 2018.
4. NarasimhaRao A.V and Venkatramaiah C., “Geotechnical Engineering”, Universities Press (India) Limited, 2015.
5. ShashiK.Gulhati and Manoj Datta, “Geotechnical Engineering”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
6. Shenbaga R.Kaniraj, “Design Aids in Soil Mechanics and Foundation Engineering” Tata McGraw Hill Education Private Limited, NewDelhi, (Thirteenth Reprint), 2017.

COURSE OUTCOMES:

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

CO1: Understand 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

19CEPC603	BASIC STRUCTURAL DESIGN - II (CONCRETE)	SEMESTER VI

L	T	P	C
3	0	0	3

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 get the concepts of limit state design of columns and footings.

UNIT- I: REINFORCED CONCRETE MATERIALS **9**

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**

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**

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.

9

UNIT- IV: LIMIT STATE DESIGN OF COLUMNS

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**

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

REFERENCES:

1. Syal I. C and GoelA.K., "Reinforced Concrete Structures", S.Chand limited 2008.
2. Pillai S. U and Menon D., "Reinforced Concrete Design", Tata McGraw Hill, 2017.
3. Shah V.L and Karve S.R., "Limit State Theory and Design of Reinforced Concrete", Structures Publications, 2014.
4. IS: 456 – 2000, Indian Standard code of practice for Plain and Reinforced concrete.
5. Subramanian N., "Design of Reinforced Concrete Structures", Oxford University Press, 2014.
6. Krishnaraju N., "Design of Reinforced Concrete Structures", CBS Publishers and Distributors Pvt Ltd, 2019.

COURSE OUTCOMES:

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

CO1: Understand the concepts of working stress and limit state methods.

CO2: Design of rectangular beams for flexure, shear and torsion.

CO3: 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.

19CEPC604 IRRIGATION ENGINEERING SEMESTER VI

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- The student is exposed to different phases in irrigation practices and Planning and management of irrigation. Further they will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management.

UNIT- I: CROP WATER REQUIREMENT 9

Need and classification of irrigation –Historical development and merits and demerits of irrigation –Types of crops –Crop season –Duty, delta and base period –Consumptive use of crops –Estimation of Evapotranspiration using experimental and theoretical methods.

UNIT- II: IRRIGATION METHODS 9

Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation –Design of drip and sprinkler irrigation –Ridge and furrow irrigation – Irrigation scheduling – Water distribution system – Irrigation efficiencies.

UNIT- III: DIVERSION AND IMPOUNDING STRUCTURES 9

Types of Impounding structures – Gravity dam – Forces on a dam – Design of Gravity dams; Earth dams, Arch dams – Diversion Head works – Weirs and Barrages.

UNIT- IV: CANAL IRRIGATION 9

Canal regulations – Direct sluice – Canal drop – Cross drainage works – Canal outlets – Design of prismatic canal – Canal alignments – Canal lining – Kennedy's and Lacey's Regime theory – Design of unlined canal.

UNIT- V: WATER MANAGEMENT IN IRRIGATION 9

Modernization techniques – Rehabilitation – Optimization of water use – Minimizing water losses – On form development works – Participatory irrigation management – Water resources associations – Changing paradigms in water management – Performance evaluation – Economic aspects of irrigation.

Contact periods:

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

REFERENCES:

1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice–Hall of India, New Delhi, 2013.
2. Punmia B.C., et.al; "Irrigation and water power Engineering", Laxmi Publications, 16th Edition, New Delhi, 2021.
3. Duggal K. N and Soni J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005.
4. Linsley R. K and Franzini J.B., "Water Resources Engineering", McGraw-Hill Inc, 2000.
5. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw-Hill Inc., New Delhi, 1997.
6. Sharma R. K., "Irrigation Engineering", S.Chand & Co. 2007.

COURSE OUTCOMES:

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

CO1: Have knowledge and skills on crop water requirements

CO2: Understand the methods and management of irrigation

CO3: Gain knowledge on types of Impounding structures

CO4: Understand methods of irrigation including canal irrigation

CO5: Get knowledge on water management on optimization of water use

19CEPC607 CONCRETE AND HIGHWAY ENGINEERING LABORATORY **SEMESTER VI**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

LIST OF EXPERIMENTS

1. **TESTS ON AGGREGATES**
   - Specific Gravity
   - Gradation of Aggregate
   - Crushing Strength
   - Abrasion Value
   - Impact Value
   - Water Absorption
   - Flakiness and Elongation Indices
2. **TESTS ON FRESH CONCRETE**
   - Slump cone test
   - Flow table
   - Compaction factor
   - Vee bee test.
3. **TESTS ON HARDENED CONCRETE**
   - Compressive strength – Cube & Cylinder
   - Flexure test
   - Modulus of Elasticity
4. **TESTS ON BITUMEN**
   - Penetration
   - Softening Point
   - Ductility
   - Flash and fire points.
   - Viscosity
5. **TESTS ON BITUMINOUS MIXES**
   - Determination of Binder Content
   - Marshall Stability and Flow values
   - Density

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: Student knows the techniques to characterize various pavement materials through relevant tests

19CEEE608 IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING **SEMESTER VI**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVE:

- The student shall conceive, design and draw the irrigation and environmental engineering structures in detail showing the plan, elevation and Sections.

PART A: IRRIGATION ENGINEERING

1. TANK COMPONENTS

Fundamentals of design – Tank surplus weir – Tank sluice with tower head – Drawings sl foundation details, plan and elevation.

2. IMPOUNDING STRUCTURES

Design principles – Earth dam – Profile of Gravity Dam.

3. CROSS DRAINAGE WORKS

General design principles – Aqueducts – Syphon aqueduct (Type III) – Canal drop (Notch Type) – Drawing showing plan, elevation and foundation details.

4. CANAL REGULATION STRUCTURES

General Principles – Direct Sluice – Canal regulator – Drawing showing detailed plan, elevation and foundation details.

PART B: ENVIRONMENTAL ENGINEERING

1. WATER SUPPLY AND TREATMENT

Design and Drawing of flash mixer, flocculator and clarifier – Rapid sand filter – Service reservoirs – Pumping station – House service connection for water supply and drainage.

2. SEWAGE TREATMENT & DISPOSAL

Design and Drawing of screen chamber – Grit channel – Primary clarifier – Activated sludge process –Aeration tank–Trickling filter – Sludge digester – Sludge drying beds – Septic tanks and disposal arrangements.

Contact periods:

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

REFERENCES:

1. Satya Narayana Murthy Challa, "Water Resources Engineering: Principles and Practice", New Age International Publishers, New Delhi, 2020.
2. Garg S.K., "Irrigation Engineering and Design of Structures", New Age International Publishers, New Delhi, 1997.
3. Mohanakrishnan A., "A few Novel and Interesting Innovative Irrigation Structures: Conceived, Designed and Executed in the Plan Projects in Tamil Nadu", Publ. No. 44 and Water Resources Development & Management Publ.No.43, IMTI Thuvakudy, Trichy, 2011.

4. Raghunath H.M., “Irrigation Engineering”, Wiley India Pvt. Ltd., New Delhi, 2011.
5. Sharma R.K., “Irrigation Engineering and Hydraulic Structures”, Oxford and IBH Publishing Co., New Delhi, 2017.
6. Peary H. S., ROWE D. R and Tchobanoglous G., “Environmental Engineering”, McGraw-Hill Book Co., New Delhi, 1995.

COURSE OUTCOME:

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

CO1: Design and draw various units of Municipal water treatment plants and sewage treatment plants and cross drainage works

19CEEE609 **SURVEY CAMP** **SEMESTER VI**

(2 WEEKS DURING V SEMESTER VACATION)

L	T	P	C
0	0	0	2

COURSE OBJECTIVE:

- The objective of the survey camp is to enable the students to get practical training in the field work.

STRATEGY:

Groups of not more than six members in a group will carry out each exercise in survey camp. The camp must involve work on a large area of not less than 40 acres outside the campus (Survey camp should not be conducted inside the campus). At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. Traverse – using Total station
2. Contouring
   (i).Radial tachometric contouring – Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line
   (ii).Block Level/ By squares of size at least 100 Meter x 100 Meter atleast 20 Meter interval
   (iii).L.S & C.S – Road and canal alignment for a Length of not less than 1 Kilo Meter at least L.S at Every 30M and C.S at every 90 M
3. Offset of Buildings and Plotting the Location
4. Sun observation to determine azimuth (guidelines to be given to the students)
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. Curve setting by deflection angle

Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey

19CEPC701 PRE - STRESSED CONCRETE STRUCTURES SEMESTER VII

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts, principles and methods of prestressing.
- To compute shear strength and ultimate shear resistance capacity as per IS code.
- To determine 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

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

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

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

UNIT- IV: CIRCULAR PRESTRESSING 9

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

UNIT- V: COMPOSITE CONSTRUCTION 9

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

REFERENCES:

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 and Vijayanand M, "Prestressed Concrete", PHI Learning Pvt. Ltd., 2016.

4. Lin T Y and Ned H. Burns., “Design of Prestressed Concrete Structures”, John Wiley & Sons, International Edition, New York, 2015.
5. DayaratnamP., “Prestressed Concrete Structures”, Oxford and IBH Publishing Company pvt Ltd, New Delhi, 2018.
6. Rajagopalan N., “Prestressed Concrete”, Narosana Publications, 2017.

COURSE OUTCOMES:

Upon completion of this 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

19CEPC702 ESTIMATION, COSTING AND VALUATION ENGINEERING **SEMESTER VII**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- The students will acquire knowledge in estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

UNIT- I: QUANTITY ESTIMATION **9**

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls –Culverts (additional practice in class room using computer software's).

UNIT- II: RATE ANALYSIS AND COSTING **9**

Standard Data – Observed data – Schedule of rates – Market rates – Standard data for man hours and machineries for common civil works – Rate analysis for all building works, canals, and roads– Cost estimates (additional practice in class room using Computer software's) – (Analysis of rates for the item of work asked, the data regarding labour, rates of material and rates of labour to be given in the Examination question paper).

UNIT- III: SPECIFICATIONS, REPORTS AND TENDERS **9**

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation –Report on estimate of residential building – Culvert – Roads – TTT Act 2000 – Tender notices –Types –Tender procedures – Drafting model tenders, E–tendering–Digital signature certificates– Encrypting – Decrypting – Reverse auctions.

UNIT- IV: CONTRACTS **9**

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, Material, Design, Construction – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration and legal requirements.

UNIT- V: VALUATION **9**

Definitions – Various types of valuations – Valuation methods – Necessity – Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent – Mortgage – Lease.

Contact periods:

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

REFERENCES:

1. DuttaB.N., 'Estimating and Costing in Civil Engineering', UBS Publishers & Distributors (P) Ltd, 2017.
2. Patil BS., 'Civil Engineering Contracts and Estimates', University Press, 2015.
3. Banerjee D N., 'Principles and Practices of Valuation', 5th Edition, Eastern Law House, 2015.

4. Tamil Nadu Transparencies in Tenders Act, 1998.
5. Arbitration and Conciliation Act, 1996.
6. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019.

COURSE OUTCOMES:

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

CO1: Estimate the quantities for buildings

CO2: Rate Analysis for all Building works, canals, and Roads and Cost Estimate

CO3: Understand types of specifications, principles for report preparation, tender notices types

CO4: Gain knowledge on types of contracts

CO5: Evaluate valuation for building and land

19CEPC706 STRUCTURAL DESIGN AND DRAWING SEMESTER VII

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

LIST OF EXPERIMENTS:

1. Design and drawing of RCC cantilever and counter fort type retaining walls with reinforcement details.
2. Design of solid slab and RCC Tee beam bridges for IRC loading and reinforcement details.
3. Design and drafting of circular and rectangular RCC water tanks.
4. Design of welded plate Girder Bridge – Truss Girder bridges – Detailed Drawings including connections.
5. Design and drawing of hemispherical bottom steel tank.
6. Bar bending schedule-Beam, Slab, Column and Foundation.

Contact periods:

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

REFERENCES:

1. Krishnaraju N., "Structural Design & Drawing", Universities Press, 2009.
2. Punmia B C, Ashok Kumar Jain and Arun Kumar Jain, "Comprehensive Design of Steel Structures", Laxmi Publications Pvt. Ltd., 2005.
3. Krishnamurthy D., "Structural Design & Drawing" – Vol. II and III, CBS Publishers, 2018.
4. Shah VL and Veena Gore, "Limit State Design of Steel Structures" IS800–2007, Structures Publications, 2009.

COURSE OUTCOME:

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

CO1: At the end of the course the student acquires hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice

19CEEE707 **MINI PROJECT** **SEMESTER VII**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To enable the students to apply the theoretical knowledge in practice.
- To impart and improve the design capability of the student.
- To provide students with an opportunity of in–depth exploration of a particular topic in the Civil Engineering.

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:

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

Contact periods:

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

COURSE OUTCOMES:

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

CO1: Identify Civil Engineering Analytical Problems based on present scenario

CO2: Understand the IS Codes & Develop the general arrangement drawings

CO3: Do detailed Analysis/Modelling, produce detailed design & drawings

CO4: Produce a bill of quantities and calculate approximate project cost

CO5: Prepare the final detailed mini project report

19CEEE708	INPLANT TRAINING - II (3 Weeks During VI Semester Vacation)	SEMESTER VII

L	T	P	C
0	0	0	0

COURSEOBJECTIVE:

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

STRATEGY:

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

COURSE OUTCOMES:

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

CO1: The intricacies of implementation textbook knowledge into practice

CO2: The concepts of developments and implementation of new technique

19CEEE804	PROJECT WORK	SEMESTER VIII

L	T	P	C
0	0	16	8

COURSEOBJECTIVE:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

Contact periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 240 Periods Total: 240 Periods

COURSEOUTCOME:

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

CO1: On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology

19CEEE805 **INTERNSHIP** **SEMESTER VIII**

(Minimum 4 Weeks During VII Semester Vacation)

L	T	P	C
0	0	0	0

COURSE OBJECTIVE:

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

STRATEGY:

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

COURSE OUTCOMES:

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

CO1: The intricacies of implementation textbook knowledge into practice

CO2: The concepts of developments and implementation of new techniques

19CEPE501	PAVEMENT ENGINEERING	L	T	P	C
		3	0	0	3

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**

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**

Various approaches of design – Empirical, Semi-empirical and theoretical methods – IRC design guidelines – Applications of different pavement design methods.

UNIT- III: RIGID PAVEMENT **9**

Stresses in rigid pavement – Evaluation – IRC design guidelines – Types of joints and their functions – Design of joints.

UNIT- IV: QUALITY CONTROL **9**

Field compaction – Rammers – Rollers – Compaction control –In-situ 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**

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

REFERENCES:

1. Khanna S.K., C.E.G. Justo and Dr.A.Veeraraghavan, "Highway Engineering", Khanna Publishers,Tenth Edition, 2018.
2. Yoder E. J and Witchak M.W., "Principles of Pavement Design", E print, New York wiley, 2015.
3. Yang, "Design of functional Pavements", McGraw Hill Publishing Company, 2020.
4. NPTEL - https://nptel.ac.in/courses/105105107/24.
5. Kadiyali L.R and Lal N. B., "Transport planning & Traffic Engineering", Khanna Publishers, 2016.
6. Sharma S.K., "Principles, Practice and Design of Highway Engineering", S. Chand & Co., Ltd., New Delhi, 2014.
7. Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, IRC: 58–2015, the Indian Roads Congress, New Delhi.

8. IRC SP20 –2002, Design and specification of Rural Roads (Manual), Ministry of rural roads, Government of India, NewDelhi, Reprint 2013.

COURSE OUTCOMES:

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

CO1: Learn the types and components of pavements and stresses in flexible pavement

CO2: Use different methods for designing flexible pavements

CO3: Understand the stresses and use of IRC guidelines for design of rigid pavement

CO4: Gain adequate knowledge on the various quality control tests

CO5: Learn about the evaluation of pavements and strengthening methods

19CEPE502	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

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: CONSTITUENT MATERIALS **9**

Cement – Different types – Chemical composition and Properties – Hydration of cement – Tests on cement – IS specifications – Aggregates – Classification – Mechanical properties and tests as per BIS – Grading requirements – Water – Quality of water for use in concrete.

UNIT- II: CHEMICAL AND MINERAL ADMIXTURES **9**

Accelerators – Retarders – Plasticizers – Super plasticizers – Water proofers – Mineral admixtures like fly ash, Silica fume, Ground granulated blast furnace slag and Metakaoline – Effects on concrete properties.

UNIT- III: PROPORTIONING OF CONCRETE MIX **9**

Principles of Mix Proportioning – Properties of concrete related to mix design – Physical properties of materials required for Mix Design – Design mix and nominal mix – BIS Method of mix design – Mix design examples.

UNIT- IV: FRESH AND HARDENED PROPERTIES OF CONCRETE **9**

Workability – Tests for workability of concrete – Segregation and Bleeding – Determination of strength Properties of hardened concrete – Compressive strength –Split tensile strength – Flexural strength – Stress-strain curve for concrete – Modulus of elasticity –Durability of concrete –Water absorption –Permeability –Corrosion test –Acid resistance- NDT.

9

UNIT- V: SPECIAL CONCRETES

Light weight concretes –Foam concrete –Self compacting concrete –Vacuum concrete – High strength concrete – Fibre reinforced concrete – Ferro cement – Ready mix concrete – SIFCON – Shotcrete – Polymer concrete – High performance concrete – Geopolymer concrete.

Contact periods:

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

REFERENCES:

1. GuptaB.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty M.S., "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2018.
3. BhavikattiS.S., “Concrete Technology”, I.K.International Publishing House Pvt. Ltd., New Delhi, 2019.
4. Santhakumar A. R., “Concrete Technology”, Oxford University Press India, 2018.
5. Neville A.M., "Properties of Concrete", Pitman Publishing Limited, London, 2011.

6. Gambhir M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2014.
7. IS10262 - 2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 2019.
8. Job Thomas, "Concrete Technology", Cengage Learning India Pvt. Ltd., Delhi, 2015.
9. Kumar P. Mehta and Paulo J M Monterio., "Concrete – Microstructure, Properties and Materials", McGraw Hill Education (India) Private Limited, New Delhi, 2017.

COURSE OUTCOMES:

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

CO1: The various requirements of cement, aggregates and water for making concrete

CO2: The effect of admixtures on properties of concrete

CO3: The concept and procedure of mix design as per IS method

CO4: The properties of concrete at fresh and hardened state

CO5: The importance and application of special concrete

19CEPE503 WATER RESOURCES ENGINEERING

L	T	P	C
3	0	0	3

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**

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**

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**

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.

UNIT- IV: DISTRIBUTION SYSTEM **9**

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.

UNIT- V: WATER LOGGING, DRAINAGE AND RIVER CONTROL **9**

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

REFERENCES:

1. Punmia B. C and Pande B. B Lal., "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd, New Delhi, 2021.

2. Santosh Kumar Garg, "Irrigation Engineering and Hydraulics Structures", Khanna Publications Pvt. Ltd, New Delhi, 2017.
3. Duggal K.N and Soni J.P., "Elements of Water Resources Engineering", New Age International Pvt. Ltd, New Delhi, 2011.
4. Gupta B. L and Amit Gupta, "Water resources System and Management", Standard Publishers Distributors, New Delhi, 2013.

COURSE OUTCOMES:

Upon completion of this 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

19CEPE504	HYDRAULIC STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To have knowledge on reservoir planning and earth dams.
- To understand the working principle of gravity dams, spillways and energy dissipaters.
- To know about hydraulic power plants.

UNIT- I: RESERVOIR PLANNING AND EARTH DAMS **9**

Reservoir Planning: Investigations – Capacities – Zones of storage – Mass Inflow and Mass Demand curves – Life of Reservoir.

Earth Dams: Types –Causes of failure and design criteria –Soils suitability for earth dam construction –Construction methods –Foundation requirements –Typical earth dam sections –Estimation of seepage through and below the dam –Seepage control –Stability of slopes by slip circle method of analysis –Pore pressures –Sudden draw down –Steady seepage and construction pore pressure condition.

UNIT- II: GRAVITY DAMS **9**

Design Criteria –Forces acting on gravity dams –Elementary profile –Low and high gravity dams –Stability analysis –Practical profile –Evaluation of profile by method of zoning –Foundation treatment –Construction joints –Galleries in gravity dams.

UNIT- III: SPILLWAYS AND ENERGY DISSIPATORS **9**

Spillways: Ogee spillway and its design –Details of siphon –Shaft –Chute and side channel spillways –Emergency spillways – Design of outlets and rating curves.

Energy dissipaters: Principles of energy dissipation Energy dissipators based on tail water rating curve and jump height curves Spillway crest gates –Vertical lift and radial gates, their design principles – Design of canal regulating structures – Design of Channel transitions – Design of Sarda type Falls – Design of cross drainage works viz Syphon aqueduct and Canal syphon.

UNIT- IV: STRUCTURES ON PERVIOUS FORMATIONS **9**

Bligh's creep theory – Limitations – Khoslas's theory of independent variable – Khosla's corrections – Design of Weir and Barrages – Design of waterways and crest levels – Design of impervious floors and protection works.

UNIT- V: CANAL STRUCTURES AND HYDROPOWER PLANTS **9**

Design of canal falls – Regulators – Cross drainage works – Introduction of Hydropower development – General features of hydro-electric schemes – Selection of turbines.

Contact periods:

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

REFERENCES:

1. Punmia B. C and Pande B. B Lal., "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd, New Delhi, 2021.
2. Santosh Kumar Garg, "Irrigation Engineering and Hydraulics Structures", Khanna Publications Pvt.Ltd, New Delhi, 2017.

3. Engineering for Dams (Volumes I, II &III) by Creager, Justin & Hinds.
4. Hydroelectric Hand Book by Creager.
5. Hydraulic Structures by Varshney.
6. Water Power Engineering by Dandekar-2016.

COURSE OUTCOMES:

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

CO1: Plan the reservoir and earthen dams.
CO2: Design and check the stability of gravity dams.
CO3: Design spillways and energy dissipaters.
CO4: Design weirs and barrages.
CO5: Design cross drainage works.

19CEPE601	STEEL STRUCTURES	L	T	P	C
		3	0	0	3

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**

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**

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**

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**

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**

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

REFERENCES:

1. Subramanian N., “Design of steel structures”, Oxford university press, 2013.
2. Duggal S.K., “Limit State Design of Steel Structures”, Tata McGraw Hill., 1st Edition, New Delhi, 2019.
3. “Teaching Resources for Structural Steel Design – Volume I and II”, INSDAG, Kolkatta, 2009.
4. Arya A. S and Ajmani J.L., “Design of Steel structures” Nem Chand and Bros. Roorkee, 2014.
5. Ramachandra., “Design of Steel structures Vol I & II”, Standard Book House, New

Delhi,2007.
6. IS:800 - 2007 - Code of practice for general construction in steel (Third revision).

COURSE OUTCOMES:

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

CO1: Understand the concept of plastic analysis

CO2: Study the behaviour and design of Beam Column subjected to eccentric force and design of base plate

CO3: Design the Gantry girder, welded plate girder, stiffeners and connections

CO4: Understand the behaviour of cold formed steel and its design

CO5: Perform Corrosion and Fire Resistant Design

19CEPE602 FUNDAMENTALS OF REMOTE SENSING AND GIS APPLICATIONS

L	T	P	C
3	0	0	3

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**

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**

Data acquisition – Active and passive remote sensing – Platforms – Aerial and space platforms – Aircraft and satellites – Synoptivity and Receptivity – Sensors – Aerial camera – Non-photographic optical sensors – Multispectral scanners – Thermal scanners, Imaging radars – SLAR and SAR LIDAR.

UNIT- III: SATELLITE REMOTE SENSING AND DIGITALIMAGE PROCESSING **9**

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**

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**

Application of satellite imagery – Merits – Limitations – Comparison with aerial photographs – Visual interpretation of satellite imagery – Elements of interpretation – Interpretation keys. GPS and it 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 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Chandra A. M and Ghosh S.K., "Remote Sensing and Geographical Information system", Narosa, Publishing house New Delhi, 2015.
2. Patel A.N and Surendrasingh, "Remote Sensing Principles and applications", Scientific Publishers, Jodhpur, 2013.
3. Thomas M.Lille Sand and Raiph W.Kiefer, "Remote Sensing and Image Interpretation", John Wiley Sons, 2015.
4. Burrough P.A., Principles of GIS for Land Resources Assessment, Oxford, 2006.
5. Bhatia S.C., "Fundamentals of Remote Sensing", Atlantic Publishers & Distributions (P) Ltd, 2019.

COURSE OUTCOMES:

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

CO1: Understand the principles and methods of remote sensing

CO2: The students will able to apply the concept of satellite remote sensing Data acquisition

CO3: Get idea of various satellites such as LANDSAT, SPOT and IRS series, types and Characteristics of imageries

CO4: To know about the hardware and software of GIS

CO5: To acquire knowledge on the application of GIS in the areas of water resources land use studies, soil science, Agriculture, forestry and Oceanography

19CEPE603	CONSTRUCTION MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand 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 understand cost management and software applications in project management.

UNIT- I: PLANNING, SCHEDULING AND ORGANISING **9**

Planning for construction projects –Objectives –Principles –Stages of planning, Scheduling – Methods –Project management through networks – CPM & PERT. Project updating – Job layout – Work breakdown Structure – Types of construction organization.

UNIT- II: RESOURCE MANAGEMENT **9**

Types of resources – Estimating resource requirements – Material management – Effective utilization of machineries and equipments – Manpower planning- Digital twin for resource management.

UNIT- III: QUALITY CONTROL **9**

Quality control in construction – Importance – Elements – Quality control methods – Statistical methods sampling by attributes – Sampling by variables.

UNIT- IV: COST CONTROL **9**

Cost control in construction – Objectives – Cost control systems – Direct and indirect cost control –Project budgetary control – Risk cost management.

UNIT- V: SAFETY MANAGEMENT **9**

Safety in construction projects – Accidents – Causes – Classification – Safety measures – Approaches to improve safety in construction – Safety codes and standards – Case studies.

Contact periods:

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

REFERENCES:

1. Chitkara K.K., "Construction Project Management: Planning, Scheduling and Control", 3rd Edition, Tata McGrawHill Publishing Co., New Delhi, 2010.
2. Seetharaman S., "Construction Engineering and Management", 2nd Edition, Umesh Publications, New Delhi, 2017.
3. Halpin D.W., "Financial and Cost Concepts for Construction Management", 1st Edition, John Wiley and Sons, New York, 1998.
4. Modar J, Phillips C and Davis, "Project Management with CPM, PERT and Precedence diagramming", 3rd Edition, Van No strands Reinhold Co., 1983.
5. https://www.southampton.ac.uk/courses/modules/cenv1023.page.
6. https://books.google.co.in/books?isbn=1259000710.

COURSE OUTCOMES

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

CO1: Schedule the projects using network techniques

CO2: Estimate the resources required for construction projects Plan and effectively utilize the resources

CO3: Execute quality control in construction projects

CO4: Implement cost control measures

CO5: Execute construction projects with safety

19CEPE604	HYDROLOGY	L	T	P	C
		3	0	0	3

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**

Hydrological cycle – Hydro meteorological factors – Cloud formation – Winds and their movement – Types of precipitation – Forms of precipitation – Density and Adequacy of rain gauges – Recording and non –Recording rain gauges – Optimum number of rain gauges.

UNIT- II: PRECIPITATION AND ABSTRACTIONS **9**

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**

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**

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.

UNIT- V: FLOOD ANALYSIS **9**

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

REFERENCES:

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, NewDelhi, 2016.
3. Subramanya K., "Engineering Hydrology", Tata McGraw–Hill Publications Pvt. Ltd, New Delhi, 2017.
4. Warren Viessman and Gary L. Lewis, "Introduction to Hydrology", Prentice Hall of India Pvt. Ltd, New Delhi, 2015.

5. David K. Todd and Larry W. Mays, “Groundwater Hydrology”, Wiley Publications Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOMES:

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

CO1: Obtain knowledge on behavior of water molecules in atmosphere

CO2: Present 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

19CEPE701	CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

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**

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**

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 Counter fort retaining wall.

UNIT- III: FLAT SLAB DESIGN **9**

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**

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**

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

REFERENCES:

1. Pillai and Menon, “Reinforced Concrete Design”, McGraw Hill Education (India) Private Ltd., 2017.
2. SinhaS N., “Reinforced Concrete Design”, Tata McGraw Hill publishing company Ltd., 2017.
3. BIS 456 – 2000, Indian Standard code of Practice for plain and Reinforced concrete.
4. BIS 3370 – Part 4 – Indian Standard Code of practice for concrete structures for the storage of liquids.
5. BIS 1893 – 2016 – Indian Standard Code of practice for Criteria for Earthquake resistant design of structures.
6. IS 13920(2016), Indian Standard Code of practice for “Ductile detailing of Reinforced

concrete structures subjected to seismic forces".

COURSE OUTCOMES:

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

CO1: Make the choice of foundation and its design as per BIS code
CO2: Make the choice of retaining walls and its design as per BIS code
CO3: Design of Flat slabs as per BIS code
CO4: Make the choice of water tanks and its design as per BIS code
CO5: Apply the provisions of earthquake resistant design and ductile detailing of structures

19CAHS004 PROFESSIONAL ETHICS IN ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the importance of Values and Ethics in their professional careers.
- To know the different ideas of engineering ethics.
- To Infer moral judgment concerning the profession
- To inculcate the sense of social responsibility.
- To know the global issues of ethics.

UNIT- I: HUMAN VALUES **9**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT- II: ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT- III: ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

9

UNIT- IV: SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT- V: GLOBAL ISSUES **9**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

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

REFERENCES:

1. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
2. Govindarajan M., Natarajan S. and Senthil Kumar V. S., "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
4. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw

Hill, New Delhi, 2003.
5. John R. Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
6. Edmund G. and Robert L. Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001.

COURSE OUTCOMES:

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

CO1: Apply human values.
CO2: Apply ethical issues related to Engineering.
CO3: Realize the code of Ethics.
CO4: Realize the responsibilities and rights in the society.
CO5: Know Global Issues.

19CEPE703 EARTHQUAKE ENGINEERING

L	T	P	C
3	0	0	3

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**

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**

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**

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**

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**

Introduction to Earthquake resistant modern techniques – Base isolation techniques – Elastomeric, 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 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCES:

1. Chopra A K., "Dynamics of structures – Theory and Applications to Earthquake Engineering, Second Edition", Pearson Education, 2015.
2. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India, NewDelhi, 2013.
3. Duggal S.K.,"Earth Quake Resistant Design of Structures", Oxford university Press,2013.

4. Damodarasamy SR and Kavitha S., "Basics of Structural Dynamics and Aseismic Design", Prentice Hall India Publishers, 2009.
5. Bruce A. Bolt, "Earthquakes", W H Freeman and Company, New York, 2004.
6. 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:

Upon completion of this 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

19CEPE704 TRAFFIC ENGINEERING AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To give an overview of Traffic elements, surveys, traffic regulation, management and traffic safety with integrated approach in traffic planning as well.
- To know the design principles of traffic signals.
- To know the design of parking facilities, clover leaf intersection and traffic rotary.

UNIT- I: INTRODUCTION **9**

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**

Surveys – Classification – Volume, Speed and delay, origin and destination –Parking, accidents –Statically methods for traffic engineering –Simple problems –Analysis – Capacity of roads – Level of service –Interpretation of traffic studies and conclusions.

UNIT- III: TRAFFIC CONTROL **9**

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**

Road accidents –Types –Causes and prevention with emphasis on engineering factors – 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

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

REFERENCES:

1. Kadiyali L. R., “Traffic Engineering and Transport planning”, Khanna Publishers, 2011.
2. SalterR. I and Hounsell N.B., “Highway Traffic Analysis and Design”, Macmillan Press Ltd., 2000.
3. Manual of Transportation Engineering studies, Institution of Transportation Engineering, Prentice hall Publications, 1994.
4. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.
5. John E. Tyworth., “Traffic Management Planning”, Operation and Control, Addison

Wesley Publishing Company, 1997.

COURSE OUTCOMES:

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

CO1: Understand traffic elements and their characteristics
CO2: Understand and conduct various traffic surveys
CO3: Understand design of traffic signals
CO4: Analyse the causes of road accidents and take controlling measures
CO5: Design of parking facilities, cower leaf intersection and traffic rotary

19CEPE705	ADVANCED CONCRETE DESIGN	L	T	P	C
		3	0	0	3

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 ANDINELASTIC BEHAVIOUR OF CONCRETE BEAMS **9**

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**

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**

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**

Design of Bunkers – Design of Silo – Detailing of reinforcements.

UNIT- V: DESIGN OF BRIDGES **9**

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

REFERENCES:

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.
3. IS 456 – 2000, “Indian standard code of practice for plain and reinforced concrete”.
4. SP 34(1987), “Handbook on Concrete Reinforcement and Detailing”, BIS, New Delhi.
5. Pillai S U and Menon D., “Reinforced Concrete Design”, Tata McGraw Hill, 2017.

COURSE OUTCOMES:

Upon completion of this 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: Analyse and design Grid floors and ribbed slabs using various methods.

CO4: Analyse and design bunkers and silos

CO5: Understand the concepts involved in the design of bridges as per Indian standards

19CEPE706	BASICS OF DYNAMICS AND ASEISMIC DESIGN OF STRUCTURES	L	T	P	C
		3	0	0	3

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 structure by using IS codal provisions.

UNIT- I: THEORY OF VIBRATIONS **9**

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**

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**

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**

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

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-case study on earthquakes.

Contact periods:

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

REFERENCES:

1. Chopra A K., "Dynamics of structures – Theory and Applications to Earthquake Engineering, Fifth Edition", Pearson Education, 2017.
2. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", PHI learning privated Limited, NewDelhi, 2013.

3. Duggal S K., “Earth Quake Resistant Design of Structures”, Oxford University Press, 2013.
4. Damodarasamy S R and Kavitha S., “Basics of Structural Dynamics and Aseismic Design”, PHI Learning Private limited, New Delhi, 2009.
5. Bruce A. Bolt, “Earthquakes” W H Freeman and Company, New York, 2004.
6. Indian Standard Codes: IS: 1893, IS: 4326 and IS:13920, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES:

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

CO1: Understand the theory of vibrations and determine response of structures
CO2: Able to analyse the causes and effects of earthquake
CO3: Plan the structures which can overcome earthquake forces
CO4: Apply Indian codal provisions in the planning, design and detailing of structures
CO5: Execute vibration control techniques in various structures

19CEPE707	FINITE ELEMENT METHOD	L	T	P	C
		3	0	0	3

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**

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 – Variation approach – Weighted mean residual methods like Collocation method, Sub domain method, Galerkin method and Least square method – Simple problems only.

UNIT- II: ELEMENTS OF ELASTICITY **9**

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**

Concept of an element – Basic element shapes – Element properties – Displacement models – Approximation displacements by Polynomials – Convergence requirements – Generalized 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**

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**

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

REFERENCES:

1. Krishnamoorthy C S., "Finite Element Analysis – Theory and Programming, 2nd Edition", Tata McGraw Hill Publishing Co., 2017.
2. Tirupathi R, Chandrupatla and Ashok D. Belugundu "Introduction to Finite Elements in Engineering, 3rd Edition", Prentice Hall India Pvt Ltd, 2011.
3. Rajasekaran S., "Finite Element Analysis in Engineering Design", Wheeler Publishing,2008.
4. ChandrapatlaTirupathi.R and Belegundu, Ashok. D., "Introduction to Finite Elements in Engineering, 2nd Edition", Prentice Hall of India, 2014.
5. Rao S.S., "The Finite Element Method in Engineering", Buttersworth – Heinemann

publishing, 2017.

COURSE OUTCOMES:

Upon completion of this 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: Familiarize about the role and significance of shape functions in finite element formulations and use linear, quadratic, and cubic shape functions for interpolation (for 1D, 2D and 3D Problems)

CO4: Familiarize the formulation of isoperimetric elements

CO5: Analyse elements subjected to axisymmetric stresses

19CEPE708	AIRPORT, DOCKS AND HARBOUR ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To expose the students to design principles of Airports.
- To know various components of a harbour, docks and their functions.
- To understand break water construction methods and functions of navigational lights.

UNIT- I: AIRPORTS SUB STRUCTURE CONSTRUCTION 9

Air transport – Development in India and important 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

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

Historical development of docks, harbour and seaports – Basic definition – Requirements and classification –Recent trends in seaport planning and construction includes 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

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

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

REFERENCES:

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.
3. Shahani P B., "Airport techniques", second edition – Oxford publishing, NewDelhi,1990.
4. Srinivasan R., "Harbour, Dock and Tunnel engineering", Charter publishing house, Anand, India,2016.

COURSE OUTCOMES:

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

CO1: Know various components of an airport

CO2: Understand design of runway and lighting pattern

CO3: Know various components of docks, harbour and their functions
CO4: Understand break water construction methods
CO5: Understand types and functions of navigational Aids

19CEPE801 SAFETY IN CIVIL ENGINEERING PRACTICES

L	T	P	C
3	0	0	3

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**

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**

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**

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**

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**

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

REFERENCES:

1.Allen St.John Hot, “Principles of Construction Safety”, John Wiley & Sons, 2008.
2.Mark Mc.Guire Moran, “Construction Safety Hand Book”, 2003.
3.David L.Geotsch, “Construction Safety and Health”, 2011.
4.Grimaldi Simonds “Safety Management”, AITBS Publishers, 2001.
5.Tim Howarth, Paul Watson, “Construction Safety Management”, 2008.

COURSE OUTCOMES:

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

CO1: Obtain knowledge on safety measures to be taken during pre –construction work
CO2: Follow the basic protective measures during construction
CO3: Choose safety measure during concreting work
CO4: Choose protective measures during truss and roof construction
CO5: Acquire knowledge on equipments needed for safety during construction

19CEPE802 PREFABRICATED STRUCTURES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge to students on modular construction and prefabricated components.
- To enhance the ability of students to analyze and design of structural members.
- To understand the methods of construction and installation of precast elements.

UNIT- I: INTRODUCTION 9

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

Beams – Columns – Roof units – Floor units –Wall panels – Footings – Dimensions of prefabricated elements.

UNIT- III: PRODUCTION TECHNOLOGY 9

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

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

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

REFERENCES:

1. Mokk L., "Prefabricated Concrete for Industrial and Public Structures", Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. Elliott K M., "Precast concrete structures", Butterworth Heinmann, 2002.
3. Structural Design Manual, "Precast Concrete Connection Details", Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 2009.
4. Ganesan and Latha, "Prefabricated structures", Sree Kamalamani Publications, Chennai, 2014.

COURSE OUTCOMES:

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

CO1: Understand the need of prefabricated structures and materials
CO2: Gain knowledge on the prefabricated components
CO3: Understand production process and methods of prefabricated elements
CO4: Do analysis, design of members and connections of precast building
CO5: Get idea on handling and installation of elements

19CEPE803 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the various dewatering techniques.
- To know the in-situ treatment of cohesion less 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**

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**

In–situ densification of granular soils and consolidation of cohesive soils – Shallow and deep compaction – Vibration methods – Vibro compaction, Blasting, Vibro flotation – 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**

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**

Stabilization methods – Mechanical, Chemical stabilization – Cement, Lime, Bitumen – Electro –Kinetic stabilization – Stabilization of expansive clays.

UNIT- V: GROUTING **9**

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

REFERENCES:

1. Purushothama Raj P., "Ground Improvement Techniques", Laxmi Publications (P) Ltd., New Delhi, 2016.
2. Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas publishing House Pvt. Ltd., 2012.
3. Day R W., "Foundation Engineering Handbook", Mc–Graw Hill Companies, Inc. 2010.
4. Rowe R.K., "Geotechnical and Geo environmental Engineering Handbook", Kluwer Academic Publishers, 2012.
5. Peter G. Nicholson, "Soil Improvement and Ground Modification Methods", Butterworth Heinemann, 2015.
6. Klaus Kirsch and Alan Bell, "Ground Improvement, 3rd Edition", CRC Press, Taylor and Francis Group, 2013.

COURSE OUTCOMES:

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

CO1: Select suitable ground improvement techniques and different dewatering techniques

CO2: Acquire knowledge on various in–situ treatments of cohesion less and cohesive soils

CO3: Understand the constructional aspects of stone column and earth reinforcement

CO4: Identify and implement suitable stabilization methods

CO5: Select and apply different grouting techniques

19CEPE804	BRIDGE ENGINEERING	L	T	P	C
		3	0	0	3

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**

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**

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**

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**

Temporary and movable bridges. RC Arch bridges (open spandrel and string girder type only) – Cable stayed bridges –Suspension bridges – Design principles only.

UNIT- V: SUBSTRUCTURE, BEARING, MAINTENANCE AND INSPECTION OF BRIDGES **9**

Bearings – Types, functions – Simple problems – Substructures – Abutment, Pier – materials – Stability requirements –Rebuilding of bridges – Replacement – Pier tops – girders – Side sleeking and end launching methods – Joints in bridges. Case studies.

Contact periods:

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

REFERENCES:

1. Jhonson Victor D., "Essentials of Bridge Engineering", Oxford & IBH publishing Co., Ltd, New Delhi, 2019.
2. Jagadeesh T RandJeyaram M R., "Design of Bridge Structures", Prentice Hall of India, 2011.
3. Vazirani V N, Ratwani M M and Vaswani, "Bridge Engineering", Khanna publishers, 2000.
4. Bindra S P., "Principles and practice of Bridge Engineering", Dhanpat Rai & Sons, New Delhi,2012.
5. Krishnaraju N., "Design of bridges", New age international publishing ltd, NewDelhi, 2005.
6. Ponnuswamy S., "Bridge Engineering", 3rd Edition, Tata McGraw Hill Publishing Co., Ltd, New Delhi, 2017.

COURSE OUTCOMES:

Upon completion of this 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

19CEPE805 MAINTENANCE AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students 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**

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**

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**

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**

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**

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

REFERENCES:

1. Dr.Vidivelli B., "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.
3. Bhattecharjee, "Concrete Structures Repair Rehabilitation and Retrofitting", CBS Publishers and Distributors, New Delhi, 2017.
4. Poonam I. Modi andChirag N. Patel,"Repair & Rehabilitation of Concrete Structures",

PHI Learning Pvt. Ltd., New Delhi, 2016.
5. Shetty M S., “Concrete Technology – Theory and Practice”, S. Chand and Company, New Delhi, 2018.

COURSE OUTCOMES:

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

CO1: Evaluate a damaged structure

CO2: Verify the quality assurance of the construction

CO3: Identify and choose the appropriate materials and techniques for various repair conditions

CO4: Execute various engineered demolition techniques for dilapidated structure

CO5: Rehabilitate and strengthen the various elements of a structure subjected to deterioration

19CEPE806 ENVIRONMENTAL LEGISLATIONS IN INDIA

L	T	P	C
3	0	0	3

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**

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**

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**

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(HWM 2016) **9**

Restriction on Hazardous waste – Biomedical 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 2016 (e-waste , plastic and construction demolition waste) **9**

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

REFERENCES:

1. Leelakrishnan P., "Environmental Law in India", Lexis Nexis 4th edition 2016.
2. Stuart Bell and Donald, "Environmental Law", McGillinary sixth edition 2008.
3. Shyam Divan and Armin Rosencrantz, "Environmental law and policy in India", Oxford University Press, New Delhi, 2017.
4. Hilary Theisen and Samuel A, Vigil and George Tchobanoglous, "Integrated Solid Waste Management", McGraw– Hill, New York, 1993.
5. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2016.
6. Michael D. LaGrega, Philip L. Buckingham, Jeffrey C. E Vans, "Environmental Resources Management, Hazardous waste Management", Mc–Graw Hill International edition, New York, 2001.

COURSE OUTCOMES:

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

CO1: Understand the National and international Environmental policies

CO2: Apply the knowledge in Planning and decision making of Environmental policies summarize the pollution control acts for water and air pollution

CO3: Understand the management and handling of Industrial solid waste and E– waste and understand the management and handling of E– waste

19CEPE807 INDUSTRIAL WASTEWATER MANAGEMENT

L	T	P	C
3	0	0	3

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.
- Knowledge about Pollution from major industries and treatment technologies.

UNIT- I: SOURCES **9**

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**

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**

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**

Industrial manufacturing process description, wastewater characteristics, source reduction points and effluent treatment flow sheet for Chemical industries – Metal finishing industries – Iron and Steel industries – Distilleries – Thermal power plant – Nuclear power plant – Petroleum refineries – Fertilizers — Pharmaceutical industry - Automobile industry– Industrial estates and industrial clusters.

UNIT- V: INDUSTRIAL WASTEWATER TREATMENT - II **9**

Industrial manufacturing process description, wastewater characteristics, source reduction points and effluent treatment flow sheet for Textiles – Sugar mill - Pulp and Paper mill – Dairy - Meat packing industries and poultry plant.

Contact periods:

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

REFERENCES:

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, 2017.
3. Eckenfelder W W., "Industrial Water Pollution Control", McGraw–Hill, 2017.
4. Soli. J. Arceivala and Shyam. R. Asolekar "Wastewater Treatment for Pollution Control and Reuse", McGraw–Hill, 2017.
5. Frank Woodard, "Industrial Waste Treatment Handbook", Butterworth Heinemann, New Delhi, 2006.
6. Nemerow N L., "Industrial Water Pollution", Addison – Wesley Publishing Company Inc., USA, 2007.

COURSE OUTCOME:

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

CO1: Carry out qualitative and quantitative assessment of industrial wastewater
CO2: Understand the principles of waste minimization techniques
CO3: Identify and select appropriate disposal methods
CO4: Manage the effluent treatment from major industries
CO5: Understand the concept of industrial clusters

19CEPE808	SUSTAINABLE ENGINEERING AND TECHNOLOGY	L	T	P	C
		3	0	0	3

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**

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**

Air pollution, Effects of air pollution; Water pollution –Sources, Sustainable wastewater treatment, Solid waste –Sources, impacts of solid waste, Zero waste concepts, 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**

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**

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**

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

REFERENCES:

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 and Mariam P., "Engineering Applications in Sustainable Design and Development", Cengage learning, 2015.
4. ECBC Code 2017, "Bureau of Energy Efficiency", New Delhi Bureau of Energy Efficiency Publications.
5. Ni Bin Chang, "Systems Analysis for Sustainable Engineering: Theory and Applications", McGraw–Hill Professional, 2010.

COURSE OUTCOMES:

Upon completion of this 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

19CAOE01 GEOGRAPHICAL INFORMATION SYSTEM

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To introduce the fundamentals and components of Geographic Information System.
- To provide details of spatial data structures and input, management and output processes.

UNIT- I: FUNDAMENTALS OF GIS **9**

Introduction to GIS – Basic spatial concepts – Coordinate Systems – GIS and Information Systems – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software – Types of data – Spatial, Attribute data – Types of attributes – Scales/ levels of measurements.

UNIT- II: SPATIAL DATA MODELS **9**

Database Structures – Relational, Object Oriented – ER diagram – Spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster vs Vector Models – TIN and GRID data models – OGC standards – Data Quality.

UNIT- III: DATA INPUT AND TOPOLOGY **9**

Scanner – Raster Data Input – Raster Data File Formats – Vector Data Input – Digitizer – Topology – Adjacency, Connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS – Concept GPS based mapping.

UNIT- IV: DATA ANALYSIS **9**

Vector Data Analysis tools – Data Analysis tools – Network Analysis – Digital Education models – 3D data collection and utilization.

UNIT- V: APPLICATIONS **9**

GIS Applicant – Natural Resource Management – Engineering – Navigation – Vehicle tracking and fleet management – Marketing and Business applications – Case studies.

Contact periods:

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

REFERENCES:

1. Kang-Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.
2. Ian Heywood, Sarah Cornelius, Steve Carver and Srinivasa Raju, "An Introduction to Geographical Information Systems", Pearson Education, 2nd Edition, 2007.

COURSE OUTCOMES:

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

CO1: Have basic idea about the fundamentals of GIS
CO2: Understand the types of data models
CO3: Get knowledge about data input and topology
CO4: Gain knowledge on data quality and standards
CO5: Understand data management functions and data output

19CAOE02	GREEN BUILDINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To introduce the different concepts of sustainable design and green building techniques and how they may be synthesized to best fit a specific construction project.

UNIT- I: INTRODUCTION **9**

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 BUILDINGS **9**

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**

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**

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**

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 – Case Study on green construction and design.

Contact periods:

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

REFERENCES:

1. Kibert C., "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2005.
2. Edward G. Pita, "An Energy Approach - Air - Conditioning Principles and Systems", Pearson Education, 2003.

3. Colin Porteous, “The New Eco–Architecture”, Spon Press, 2002.
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. Ganesan T P., “Energy Conservation in Buildings”, ISTE Professional Center, Chennai, 1999.

COURSE OUTCOMES:

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

CO1: Describe the concepts of sustainable design

CO2: Familiarize with green building techniques including energy efficiency management

CO3: Understand the indoor environmental quality management in green building

CO4: Perform the green building rating using various tools

CO5: Create drawings and models of their own personal green building project

19CAOE03	PLANNING OF SMART CITIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To have an exposure on development of smart cities considering various fields related and their challenges.

UNIT- I: SMART CITIES DEVELOPMENT POTENTIALS AND CHALLENGES **9**

Perspectives of smart cities: Introduction and overview – Implementation challenges – Methodological issues – Spatial distribution of startup cities – Re imagining post industrial cities – Implementation challenges for establishing smart urban information and knowledge management system.

UNIT- II: ROLE OF ICT, REMOTE SENSING, AND GEOGRAPHICAL INFORMATION SYSTEM **9**

Optimizing green spaces for sustainable urban planning – 3D city models for extracting urban environmental quality indicators – Assessing the rainwater harvesting potential – The strategic role of green spaces – Monitoring urban expansion.

UNIT- III: ENVIRONMENT, ENERGY, DISASTER MANAGEMENT AND SUSTAINABLE DEVELOPMENT **9**

Alternatives for energy stressed cities – Social acceptability of energy – Efficient lighting – Energy management – Urban dynamics and resource consumption – Issues and challenges of sustainable tourism – Green buildings: Eco-friendly technique for modern cities.

UNIT- IV: MULTIFARIOUS MANAGEMENT FOR SMART CITIES **9**

An Assessment of domestic water use practices – An issue of governance in urban water supply – Assessment of water consumption at urban household level – Water sustainability – Socio-economic determinants and reproductive healthcare system – Problems and development of slums.

UNIT- V: INTELLIGENT TRANSPORT SYSTEM **9**

Introduction to Intelligent Transportation Systems (ITS) – The range of ITS applications – Network optimization – Sensing traffic using virtual detectors - In-vehicle routing, and Personal route information – The smart car-commercial routing and delivery – Electronic toll collection – The smart card – Dynamic assignment – Traffic enforcement. urban Mobility and economic development.

Contact periods:

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

REFERENCE:

1. Poonam Sharma and Swati Rajput, "Sustainable Smart Cities in India Challenges and Future Perspectives", Springer 2017 Co.(P) Ltd. 2013.
2. Ivan Nunes Da Silva, "Rogerio Andrade Flauzino-Smart Cities Technologies" – ExLi4EvA, 2016.
3. Stan McClellan, Jesus A. Jimenez and George Koutitas (eds.), "Smart Cities Applications, Technologies, Standards, and Driving Factors", Springer International

Publishing, 2018.
4. Stan Geertman, Joseph Ferreira, Jr. Robert Goodspeed and John Stillwell., "Planning Support Systems and Smart Cities" , Springer, 2015.

COURSE OUTCOME:

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

CO1: Identify the potential and challenges in smart city development
CO2: Apply the different tools for sustainable urban planning
CO3: Understand the concepts of environment, energy and disaster management
CO4: Identify the proper methods for water and waste water management
CO5: Familiarize with the intelligent transport systems

19CAOE04	VASTU SCIENCE FOR BUILDING CONSTRUCTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart basic knowledge of Vastu science and its impact on human well being.

UNIT- I: INTRODUCTION **9**

Traditional definition – Meaning of Vastu and Vaastu - its classification – Relationship to earth – Concept of existence and manifestation – Placatory influence on earth.

UNIT- II: SPACE THEORY IN VASTU **9**

Features of good building site – Good building shapes – Macro, micro, enclosed and material spaces – Relationship between built space, living organism and universe – Impact of built space on human psyche. Flow of energy within built space and outside – Zoning of functional areas – Fitting of components in the building – Significance of water bodies and energy – The cube as the basic structure.

UNIT- III: COSMOGRAM & SETTLEMENT CONCEPTS **9**

Orientation of building, site, layout and settlement – Positive and negative energies – importance of cardinal and ordinal directions – The celestial grid or- mandala and its type. The Vaastu Purusha Mandala and its significance in creation of patterns, and lay-outs, extension of this to aural and visual fields.

UNIT- IV: INTERFACE OF TIME, VIBRATION AND RHYTHM **9**

Theory of vibration and energy transfer – Equation of time and space – Manifestation in living organism – Human beings – Measurement of the energy – Kirlian energy of various forms – Documentation of objects – Filaments and streamers.

UNIT- V: MEASUREMENTS & MATERIALS **9**

Units of measurement – Mana shastra – Ayadi techniques – Tala system and Hasta system of measures – Musical measurements compared to space measurements – Resultant ambience in built space. Use of wood, stone, metal, brick and time – Making technology, corbelling technology, jointing technology – Foundations for heavy and light structures – Landscaping in and around buildings – Aesthetic in Indian Architecture.

Contact periods:

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

REFERENCES:

1. Dr. Prasanna Kumar Acharya, “Manasara”, Oxford1 University Press, (English version), 1927.
2. Subramanya Sastri K.S., “Maya Matam”, Thanjavur Maharaja Sarjoji Saraswathil Mahal Library, Thanjavur, 1966.
3. Stella Kramresh, “The Hindu Temple Vol.1 & II”, Motital Banarsidass Publishers Pvt. Ltd., Delhi, 1994.
4. Bruno Dagens, “ Mayamatam, Vol.1 & IIIGNCA and Motilal Bamarsidars Publishers Pvt. Ltd–s Delhi –1994.
5. George Birdsall – Feng Shui: The Key Concepts , January 2011.

COURSE OUTCOMES:

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

CO1: Obtain exposure on various concepts of Vastu

CO2: Understand the theories in Vastu

CO3: familiarize with the Cosmo gram and settlement concepts of Vastu

CO4: Understand the role of Vastu in energy flow manifestation in living beings

CO5: Plan a structure considering various Vastu techniques

19CAOE05 DISASTER MANAGEMENT AND MITIGATION	L	T	P	C
	3	0	0	3

COURSE OBJECTIVE:

- 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

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

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 acceptability Alternatives, Personnel. Political/ social, Economic vulnerability – Physical profile, Social profile, Environmental profile, Economic profile. Factors influencing vulnerability, Risk perception.

UNIT- III: MITIGATION AND PREPAREDNESS 9

Mitigation – Types of mitigation, Obstacles in mitigation, Assessment and selection of mitigation options, Emergency response capacity as incorporating mitigation into development and relief projects. Preparedness – Government preparedness, Public preparedness, Media as a public educator. Obstacles to public education and preparedness.

UNIT- IV: RESPONSE AND RECOVERY 9

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

Governmental disaster management agencies – Fire, law, Emergency management, Emergency medical service, Military 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. Nongovernmental organizations – Operations, NGO/ military coordination, standard of conduct. The role of private sector and academia. Multilateral organizations – UN agencies and programmers', Regional & International organizations. 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

REFERENCES:

1. Brassard, Caroline, Giles, David W and 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 OUTCOMES:

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

CO1: Get knowledge about basics of Disaster management
CO2: Impact knowledge about Hazards and vulnerability
CO3: Know about Mitigation and preparedness
CO4: Attain knowledge about response and recovery
CO5: Learn about the participants involved in the disaster management activity

19CAOE06 OPEN SOURCE TECHNOLOGIES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To differentiate open source software and commercial software.
- To familiarize with Linux operating system.
- To develope web applications using open source web technologies like Apache, MySQL and PHP (LAMP/XAMP).

UNIT-I:OPEN SOURCE **9**

Introduction to Open Source – Open Source vs. Commercial Software – What is Linux? - Free Software – Where I can use Linux? Linux Kernel – Linux Distributions.

UNIT-II: LINUX **9**

Introduction to Linux Essential Commands - Filesystem Concept - Standard Files - The Linux Security Model - Vi Editor - Partitions creation - Shell Introduction - String Processing - Investigating and Managing Processes - Network Clients – Installing Application.

UNIT-III:APACHE **9**

Apache Explained - Starting, Stopping, and Restarting Apache - Modifying the Default Configuration - Securing Apache - Set User and Group - Consider Allowing Access to Local Documentation - Don't Allow public html Web sites - Apache control with access.

UNIT-IV:MYSQL **9**

Introduction to MYSQL - The Show Databases and Table - The USE command - Create Database and Tables - Describe Table - Select, Insert, Update, and Delete statement - Some Administrative detail - Table Joins - Loading and Dumping a Database.

UNIT-V:PHP **9**

Introduction- General Syntactic Characteristics - PHP Scripting - Commenting your code - Primitives, Operations and Expressions - PHP Variables - Operations and Expressions Control Statement - Array - Functions - Basic Form Processing - File and Folder Access - Cookies - Sessions - Database Access with PHP - MySQL - MySQL Functions - Inserting Records - Selecting Records - Deleting Records - Update Records.

Contact Periods:

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

REFERENCES:

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, Sixth Edition, OReilly Media, 2009.
2. James Lee and Brent Ware ,"Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", , Dorling Kindersley(India) Pvt. Ltd, 2008.
3. Eric Rosebrock, Eric Filson ,"Setting Up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons, 2004.

COURSE OUTCOMES:

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

CO1: Differentiate the open source software and commercial software

CO2: Identify, install and run Linux operating system

CO3: Identify and install open source web technology Apache and manage applications
CO4: Manage users and privileges in MySQL and to handle SQL functions
CO5: Design and develop complete website using PHP

19CAOE07	ETHICAL HACKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand numerous methods of real-world information intelligence.
- To learn about vulnerability scanners.
- To understand techniques used to sniff traffic across a network.
- To familiarize with the methodologies that can be used to hack into a target.
- To appreciate the wide variety of attacks that can be performed against a wireless network.

UNIT-I:INTRODUCTION TO HACKING **9**

Terminologies, Categories of penetration test, Writing reports, Structure of a penetration Testing report, Vulnerability assessment summary, Risk assessment, Methodology, Linux basics: File structure, Cron Job, Users, Common applications, Back track, Services.

UNIT-II:INFORMATION GATHERING, TARGET ENUMERATION AND PORT SCANNING TECHNIQUES **9**

Active, Passive and sources of information gathering, Copying Websites locally, Neo Trace, Cheops-ng, Intercepting a response, WhatWeb, Netcraft, Basic parameters, Xcode Exploit scanner, Interacting with DNS servers, Fierce, Zone transfer with host command and automation, DNS Cache snooping – Attack scenario, Automating attacks, SNMP – Problem, Sniffing passwords, Solarwinds Toolset, Sweep, Brute Force and Dictionary – Tools , Attack, Enumeration, Intelligence gathering using shodan, Target enumeration and Port scanning techniques.

UNIT-III:VULNERABILITY ASSESSMENT & NETWORK SNIFFING **9**

Introduction to vulnerability assessment – Pros and cons, NMap, Updation of database, Testing SCADA environments with Nmap, Nessus, Sniffing: Types, Hubs versus Switches, Modes, MITM attacks, ARP protocol basics – working, Attacks, DoS attacks, Dsniff tool, Using ARP spoof to perform MITM attacks, Sniffing the Traffic with Dsniff, Sniffing pictures with Drifnet, Urlsnarf and Webspy, Sniffing with Wireshark, Ettercap – ARP poisoning, Hijacking session with MITM attack, ARP poisoning with CAIN and Abel, Sniffing session Cookies with Wireshark, Hijacking the session, SSL strip: Stripping HTTPS traffic, Requirements, Automating man in the middle attacks, DNS spoofing, DHCP spoofing.

UNIT-IV:BASICS OF EXPLOITATION **9**

Remote exploitation : Understanding network protocols, Attacking network remote services, Common target protocols, Tools for cracking network remote services, Attacking SMTP, Attacking SQL servers, Client side exploitation methods: E-Mails leading to malicious attachments and malicious links, Compromising client side update, Malware loaded on USB sticks, Post exploitation: Acquiring situation awareness, Privilege escalation, Maintaining access, Data mining, Identifying and exploiting further targets, Windows exploit development basics.

UNIT-V:WIRELESS& WEB HACKING **9**

Wireless hacking : Requirements, Air cracking, Hidden SSIDs, Monitor mode, Monitoring tool – Beacon frames on Wireshark, Airodump-ng, Wireless adapter in monitor mode, Determining the target, Cracking a WPA/WPA2 wireless network Using Air cracking, Capturing packets and Four-Way handshake, Web hacking : Attacking the authentication, Brute force and dictionary attacks, Types of authentication, Crawling restricted links, Testing

for the vulnerability, Authentication bypass with insecure cookie handling, SQL Injection, XSS – DOM based, BeEF, CSRF, Bypassing CSRF and BeEF with XSS, Vulnerability in FCK editor, Efront.

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

REFERENCES:

1. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2015.
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress Media, 2nd Revised Edition, 2013.
3. Michael T. Simpson, Kent Backman, James E. Corley, "Hands On Ethical Hacking and Network Defense", Cengage Learning, 2012.

COURSE OUTCOMES:

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

CO1: Comprehend the basic concepts of hacking
CO2: Know the core concepts related to malware, hardware and software vulnerabilities and their causes
CO3: Recognize ethics behind hacking and vulnerability disclosure
CO4: Appreciate the Cyber Laws and impact of hacking
CO5: Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies

19CAOE08	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand smart objects and IoT architectures.
- To learn about various IoT-related protocols.
- To build simple IoT systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT.
- To develop IoT infrastructure for popular applications.

UNIT-I:FUNDAMENTALS OF IoT **9**

Evolution of internet of things –Enabling technologies – IoT architectures: oneM2M, IoT World Forum (IoTWF) and alternative IoT models – Simplified IoT architecture and core IoT functional stack – fog, Edge and cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart objects and Connecting smart objects.

UNIT-II: IOT PROTOCOLS **9**

IoT access technologies: Physical and MAC layers, topology and security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network layer: IP versions, Constrained nodes and constrained networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over low power and lossy networks – Application transport methods: Supervisory control and data acquisition – Application layer protocols: CoAP and MQTT.

UNIT-III:DESIGN AND DEVELOPMENT **9**

Design methodology – Embedded computing logic – Microcontroller, System on chips –IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi - Interfaces and raspberry Pi with Python programming.

UNIT-IV:DATA ANALYTICS AND SUPPORTING SERVICES **9**

Structured Vs Unstructured data and data in motion Vs data in rest – Role of machine learning – No SQL databases – Hadoop ecosystem – Apache Kafka, Apache spark – Edge streaming analytics and network analytics – Xively cloud for IoT, Python Web application framework – Django – AWS for IoT – System management with NETCONF – YANG.

UNIT-V:CASE STUDIES AND INDUSTRIAL APPLICATIONS **9**

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged plant wide Ethernet model (CPwE) – Power utility industry – Grid blocks reference model – Smart and connected cities: Layered architecture, Smart lighting, Smart parking architecture and Smart traffic control.

Contact Periods:

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

REFERENCES:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.
2. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
3. Olivier Hersent, David Boswarthick and Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012 .

4. Jan Ho ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things, Springer, 2011.
6. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

COURSE OUTCOMES:

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

CO1: Explain the concept of IoT
CO2: Analyze various protocols for IoT
CO3: Design a PoC of an IoT system using Rasperry Pi/Arduino
CO4: Apply data analytics and use cloud offerings related to Io
CO5: Analyze applications of IoT in real time scenario

19CAOE09	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the criteria for test cases.
- To learn the design of test cases.
- To understand test management and test automation techniques.
- To apply test metrics and measurements.

UNIT-I:INTRODUCTION **9**

Testing as an engineering activity – Testing as a process – Testing maturity model- Testing axioms – Basic definitions – Software testing principles – The tester's role in a software development organization – Origins of defects – Cost of defects – Defect classes – The defect repository and test design – Defect examples - developer/tester support of developing a defect repository.

UNIT-II: TEST CASE DESIGN STRATEGIES **9**

Test case design strategies – Using black box approach to test case design – Boundary value analysis – Equivalence Class partitioning – State based testing – Cause-effect graphing – Compatibility testing – User documentation testing – Domain testing - Random testing – Requirements based testing – Using white box approach to test design – Test adequacy criteria – Static testing vs. structural testing – Code functional testing – Coverage and control flow graphs – Covering code logic – Paths – Code complexity testing – Additional white box testing approaches- Evaluating test adequacy criteria.

UNIT-III:LEVELS OF TESTING **9**

The need for levels of testing – Unit test – Unit test planning – Designing the unit tests – The test harness – Running the unit tests and recording results – Integration tests – Designing integration tests – Integration test planning – Scenario testing – Defect bash elimination system Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Adhoc testing – Alpha, Beta tests – Testing OO systems – Usability and accessibility testing – Configuration testing –Compatibility testing – Testing the documentation- Website testing.

UNIT-IV:TEST MANAGEMENT **9**

People and organizational issues in testing – Organization structures for testing teams – Testing services – Test Planning – Test plan components – Test plan attachments – Locating test items – test management – test process – Reporting test results – Introducing the test specialist – Skills needed by a test specialist – Building a testing group- The structure of testing group, The technical training program.

UNIT-V:TEST AUTOMATION **9**

Software test automation – Skills needed for automation – Scope of automation – Design and architecture for automation – Requirements for a test tool – Challenges in automation – Test metrics and measurements – Project, Progress and Productivity metrics.

Contact Periods:

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

REFERENCES:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007.
3. Iene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
4. Edward Kit," Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
5. Boris Beizer," Software Testing Techniques" , 2nd Edition, Van Nostrand Reinhold, New York, 1990.
6. Aditya P. Mathur, "Foundations of Software Testing Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

COURSE OUTCOMES:

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

CO1: Design test cases suitable for a software development for different domains
CO2: Identify suitable tests to be carried out
CO3: Prepare test planning based on the document
CO4: Document test plans and test cases designed
CO5: Use automatic testing tools, develop and validate a test plan

19CAOE10	USER INTERFACE DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts user interface design.
- To design Menus and GUI.
- To understand the components of windows control.
- To visualize web controls.

UNIT-I:INTRODUCTION **8**

Human-Computer interface - Characteristics of graphics interface - Direct manipulation Graphical system - Web user interface – Popularity – Characteristic & principles.

UNIT-II: HUMAN COMPUTER INTERACTION **10**

User Interface design process - Obstacles – Usability - Human characteristics in design – Human Interaction speed - Business functions - Requirement analysis - Direct - Indirect methods - Basic business functions - Design standards - System timings - Human consideration in screen design - Structures of menus - Functions of menus - Contents of menu – Formatting - Phrasing the menu - Selecting menu choice - Navigating menus - Graphical menus.

UNIT-III:WINDOWS **9**

Characteristics - Components - Presentation styles - Types - Managements - organizations - Operations - Web systems - Device-based controls Characteristics - Screen-based controls - Operate control – Text boxes – Selection control - Combination control - Custom control – Presentation control.

UNIT-IV:MULTIMEDIA **9**

Text for web pages - Effective feedback - Guidance and Assistance - Internationalization - Accessibility – Icons - Image – Multimedia - Coloring.

UNIT-V:WINDOWS LAYOUT-TEST **9**

Prototypes - Kinds of tests – Retest – Information search - Hypermedia - WWW -Software tools -Visualizations to present and explore big data -Visualization of text data and protein sequences.

Contact Periods:

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

REFERENCES:

1. Wilbent O. Galitz,"The Essential Guide To User Interface Design", John Wiley &Sons, 2001.
2. Ben Sheiderman, "Design The User Interface", Pearson Education, 1998.
3. Alan Cooper, "The Essential of User Interface Design", Wiley Dream Tech, 2002.

COURSE OUTCOMES:

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

CO1: Design the GUI components
CO2: Design the Menu components
CO3: Design the windows based controls
CO4: Realize multimedia components
CO5: Design windows layout for big data

19CAOE11 AUTOMOTIVE ELECTROICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of Automotive Electronics and its evolution.
- To introduce overview of automotive systems and subsystems.
- To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
- To understand, design and model various automotive control systems using Model based development technique.
- To understand role of Embedded in various communication systems, wired and wireless protocols used in vehicle networking.

UNIT-I: AUTOMOTIVE MECHANICAL SYSTEMS: VEHICLE SYSTEMS 9

Power train system (Air system, Fuel system (carburetor and diesel fuel injection, Ignition system, Exhaust system and other auxiliary systems (cooling, lubrications and electrical systems), Transmission system (Front, rear and 4 wheel drive, manual, automatic transmission, differential). Braking system (drum, disc, hydraulic, pneumatic), Steering system (rack and pinion, power steering).

UNIT-II: ELECTRONICS IN AUTOMOTIVE SYSTEMS 9

Need for electronics in automotive systems: Performance (speed, power, and torque), Control (emission, fuel economy, drivability, and safety) and legislation (environmental legislation for pollution and Safety Norms). Overview of vehicle electronic systems: Basic electrical components and their operation in an automobile: Power train subsystem (Starting systems, Charging systems – Ignition systems – Electronic fuel control), Chassis subsystem (ABS, TCS, and ESP) – Comfort and safety subsystems (Night vision, Airbags, Seatbelt Tensioners, Cruise control– Lane– Departure– Warning, Parking).

UNIT-III: INTEGRATED DEVELOPMENT ENVIRONMENT 9

Introduction to integrated development environment (IDE) – Getting started, HW / SW configuration (boot service, Host – Target interaction) – Booting reconfiguration – Managing IDE – Target servers, agents, Cross development, debugging – Introduction to an IDE for lab board – RTOS, PC based debugger.

UNIT-IV: EMBEDDED SYSTEM IN AUTOMOTIVE APPLICATIONS 9

Engine management systems – Gasoline / Diesel systems, various sensors used in system – Electronic transmission control – Vehicle safety system – Electronic control of braking and traction – Body electronics – Infotainment systems – Navigation systems – System level tests – Software calibration using engine and vehicle dynamometers – Environmental tests for electronic control unit – Application of control elements and control methodology in automotive system.

UNIT-V: EMBEDDED SYSTEM COMMUNICATION PROTOCOLS 9

Introduction to control networking – Communication protocols in embedded systems – SPI, I2C, USB – Vehicle communication protocols – Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000.

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

REFERENCES:

1. Joerg Schaeuffele, Thomas Zurawka, "Automotive Software Engineering Principles, Processes, Methods and Tools", SAE International, 2005.
2. Robert Bosch, "Automotive Handbook", John Wiley and Sons, 6th Edition, 2014.
3. Denton. T., "Automobile Electrical and Electronic Systems", 4th Edition, 2012.
4. Ronald K. Jurgen, "Automotive Electronics Handbook", McGraw Hill Publications, 1999.
5. Nicholas Navit, "Automotive Embedded System Handbook", CRC Press, Taylor and Francis Group, 2009.
6. Knowles D., "Automotive Electronic and Computer Controlled Ignition Systems", Prentice Hall, 1998.
7. William B. Ribbens, "Learning Automotive Electronics", Newnes Publishing, 6th Edition 2003.

COURSE OUTCOMES:

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

CO1: Describe various mechanical systems in an automobile

CO2: Illustrate different types of electronic systems in an automobile

CO3: Outline the various stages of integrated development environment to design an embedded system

CO4: Explain the various embedded systems used in automotive applications

CO5: Compare Vehicle Communication Protocols

19CAOE12 HARDWARE DESCRIPTIVE LANGUAGE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart the skill in various modeling in Verilog.
- To understand the basics of Verilog HDL.
- To learn the features in Verilog HDL.
- To understand the branching in Verilog,
- To be familiar with programming in digital circuits.

UNIT-I: OVERVIEW OF DIGITAL DESIGN WITH VERILOG HDL 9

Overview of Digital Design with Verilog HDL, Evolution of CAD, emergence of HDLs, typical HDL-flow, Trends in HDLs. Hierarchical Modeling Concepts Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block.

UNIT-II: BASIC CONCEPTS 9

Basic Concepts, Lexical conventions, data types, system tasks, compiler directives. Modules and Ports, Module definition, port declaration, connecting ports, hierarchical name referencing.

UNIT-III: GATE-LEVEL MODELING 9

Gate-Level Modeling - Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. Dataflow Modeling, Continuous assignments, delay specification, expressions, operators, operands, operator types.

UNIT-IV: BEHAVIORAL MODELING 9

Behavioral Modeling, Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks.

UNIT-V: LOGIC DESIGN USING VERILOG 9

Basic concepts – Identifiers – Procedural assignments – Design of combinational and sequential circuits using data flow – Structural gate level – Switch level modeling and behavioral modeling – Test benches.

Contact periods:

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

REFERENCES:

1. Bhasker J., “Verilog HDL”, Prentice Hall, 2000.
2. Stephen Brown, “Fundamental of Digital logic with Verilog Design”, Tata McGraw Hill, 2008.
3. Samir Palnitkar, “Verilog HDL”, Pearson, 2nd Edition, 2003.
4. Zainalabedin Navabi, “Verilog digital systems design”, McGraw Hill, 2nd Edition, 1999.
5. Charles H Roth Jr., “Digital System Design using VHDL”, Thomson learning, 2004.

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of Verilog HDL

CO2: Gain the knowledge about various modeling in Verilog HDL

CO3: Be familiar with features in Verilog HDL

CO4: Understand the fundamentals branching Verilog HDL

CO5: Analyze the logic design using Verilog HDL

19CAOE13	EMBEDDED SYSTEM DESIGN USING ARM PROCESSOR	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand ARM7TDMI assembly instructions and their formats and usage.
- To be very good in writing ARM7 based assembly level programs.
- To understand how various coprocessors are interfaced in a SoC.
- To be very conversant and knowledgeable in cache design, virtual memory and memory protection concepts and their implementation details in a typical SoC designs.
- To know about various families of ARM and different case studies.

UNIT-I: ARM ARCHITECTURE **9**

Advanced RISC machine – Architecture inheritance – ARM programming model – ARM development tools – 3 and 5 stages pipeline ARM organization – ARM instruction execution and implementation – ARM Co-Processor interface.

UNIT-II: ASSEMBLY LANGUAGE PROGRAMMING **9**

ARM instruction types – Data transfer, Data processing and control flow instructions – ARM instruction set – Co-processor instructions – Data processing instruction – Data transfer instruction – Control flow instructions.

UNIT-III: THE THUMB INSTRUCTION SET **9**

Thumb bit in the CPSR – Thumb programmer‘s model – Thumb branch instructions – Thumb software interrupt instruction – Thumb data processing instructions – Thumb single register data transfer instructions – Thumb multiple register data transfer instructions – Thumb breakpoint instructions – Thumb implementation – Thumb applications.

UNIT-IV: MEMORY HIERARCHY **9**

Memory size and speed – On-chip memory – Caches – Cache design – Memory management – Examples and exercises. Abstraction in software design – Date type – Floating point data type and architecture – Expressions – Conditional statement – Loops – Functions and procedures – Use of memory.

UNIT-V: ARM PROCESSOR AND CPU CORES. **9**

ARM cores – ARM architecture – ARM7TDMI, ARM8, ARM9TDMI, ARM10TDMI, ARM710T – ARM810 – ARM920T AND ARM940T – ARM1020E – Case study.

Contact periods:

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

REFERENCES:

1. Steve Furber, “ARM System on Chip Architecture‖ Addison”, Wesley Professional, 2nd Edition, Aug 2000.

2. Andrew N. Sloss, Dominic Symes and Chris Wright, “ARM System Developer‘s Guide Designing and Optimizing System Software”, Morgan Kaufmann Publishers, Elsevier, 2004.

3. Ricardo Reis, “Design of System on a Chip: Devices and Components”, Springer, 1st Edition, July 2004.

4. Jason Andrews-Co, “Verification of Hardware and Software for ARM System on Chip

Design (Embedded Technology)", Newnes, BK and CD– ROM (Aug 2004).
5. Rashinkar P., Paterson and Singh L., "System on a Chip Verification – Methodologies and Techniques", Kluwer Academic Publishers, 2001.
6. David Seal, "ARM Architecture reference Manual", Addison – Wesley Professional; 2nd Edition, 2001.
7. Alan Clement, "The principle of computer Hardware", 3rd Edition, Oxford University Press.

COURSE OUTCOMES:

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

CO1: Explain ARM architecture
CO2: Illustrate special features of ARM instruction set
CO3: Make use of thumb instruction set to write assembly language program
CO4: Explain memory and I/O management with ARM processor
CO5: Review different ARM CPU cores

19CAOE14 BIO-INSPIRED COMPUTING TECHNOLOGIES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concept of Genetic algorithm.
- To learn the operators in Genetic algorithm.
- To understand the concept of PSO algorithm.
- To introduce advanced optimization algorithm.
- To know about hybrid optimization algorithm.

UNIT-I: INTRODUCTION **9**

Features of Evolutionary Computation –Advantages of Evolutionary Computation – Applications of Evolutionary Computation.

Genetic Algorithms: Introduction –Conventional Optimization and Search Techniques – Advantages and Limitations of Genetic Algorithm–Terminologies and Operators of GA.

UNIT-II: OPERATORS AND APPLICATIONS **9**

Advanced Operators and Techniques in Genetic Algorithm–Classification of Genetic Algorithm –Application of GA in solving combinatorial optimization problems

UNIT-III: PSO ALGORITHM **9**

PSO Algorithm –Accelerated PSO – Implementation –Convergence Analysis –Binary PSO – Applications. Ant Colony Optimization–Characteristics- Algorithm –Applications.

UNIT-IV: ADVANCED OPTIMIZATION ALGORITHM **9**

Cuckoo Life Style – Flowchart –Algorithm , Bat Algorithms – Echolocation of Bats – Flowchart– Algorithm, Bee-Inspired Algorithms – Flowchart – Algorithm

UNIT-V: HYBRID OPTIMIZATION ALGORITHM **9**

Teacher-Learner Based Optimization algorithm –Jaya Algorithm–Hybrid OptimizationAlgorithm (Any Two)

Contact periods:

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

REFERENCES:

1. Sivanandam S. N. and Deepa S.N., "Introduction to Genetic Algorithms", 1stEdition, Springer, USA, 2008.
2. OmidBozorg - Haddad, "Advanced Optimization by Nature-Inspired Algorithms", Springer, Volume 720, Singapore, 2018.
3. SrikantaPatnaik, Xin-She Yang and Kazumi Nakamatsu, "Nature-Inspired Computing and Optimization Theory and Applications", Springer, Volume 10,USA, 2017.
4. Nancy Arana-Daniel, Carlos Lopez-Franco, Alma Y Alanis, “Bio-inspired Algorithms for Engineering”, Butterworth-Heinemann 2018.
5. David E. Goldberg, “Genetic Algorithm in search, Optimization and Machine Learning” Pearson Education India, 2008.

COURSE OUTCOMES:

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

CO1: Explain concept of Genetic algorithm.
CO2: Illustrate operators in Genetic algorithm.
CO3: Gain knowledge on the concept of PSO algorithm.
CO4: Explain the concepts on advanced optimization algorithm.
CO5: Review about hybrid optimization algorithm.

19CAOE15	VEHICULAR COMMUNICATION AND NETWORKING TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the vehicle-to-x (v2x) communication.
- To conceptualize standards and technologies.
- To understand the basicswireless propagation and channel characteristics.
- To learn Medium access control (MAC).
- To introduction to vehicular networks.

UNIT-I: VEHICLE-TO-X (V2X) COMMUNICATION 9

Vehicle-to-X (V2X) Communication for Intelligent Transportation Systems (ITS) - safety and non-safety applications, use cases, network service requirements of different applications, V2X communication regimes.

UNIT-II: STANDARDS AND TECHNOLOGIES 9

Standards and Technologies - layered architecture, infrastructure-based vs. infrastructure-less technologies, Long-Term Evolution (LTE), Dedicated Short Range Communication (DSRC), Wireless Access in Vehicular Environments (WAVE).

UNIT-III: WIRELESS PROPAGATION AND CHANNEL CHARACTERISTICS 9

Wireless Propagation and Channel Characteristics - path loss, shadowing, small-scale fading, delay spread and Doppler spread, coherence bandwidth and coherence time, techniques for combating wireless channel impairments; Physical Layer - digital modulation schemes in DSRC, design of OFDM in DSRC (symbol time, sub-carrier spacing, pilot spacing).

UNIT-IV: MEDIUM ACCESS CONTROL (MAC) 9

802.11p EDCA, multi-channel operation in the WAVE MAC; Routing - flooding, broadcast storm problem, Geocast; Security and Privacy in Vehicular Networks; Vehicular Network Simulation - mobility models, bidirectionally coupled road traffic and communication network simulators for vehicular network simulation.

UNIT-V: INTRODUCTION TO VEHICULAR NETWORKS

Introduction to Vehicular Networks: Controller Area Networks (CAN) , Field of application, Physical layer and bit coding, Frame types and format, Bit stuffing and synchronization, Error management, Overview of Other communication protocols: LIN, Flex ray.

Contact periods:

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

REFERENCES:

1. Christophe Sommer and Falko Dressler, “Vehicular Networking”, Cambridge University Press, 2014.
2. Hannes Hartenstein and Kenneth Laberteaux(eds.), “VANET Vehicular Applications and Inter-networking Technologies”, John Wiley & Sons, 2009.
3. Claudia Campolo, Antonella Molinaro and Riccardo Scopigno, “Vehicular ad hoc Networks: Standards, Solutions, and Research”, Springer, 2015.
4. Theodore S. Rappaport, “Wireless Communications: Principles and Practice”, Second

Edition, Prentice Hall, 2001.
5. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
6. Dominique Paret, “Multiplexed Networks for Embedded Systems: CAN, LIN, Flex Ray, Safe–by–Wire”, First Edition, Wiley, 2007.

COURSE OUTCOMES:

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

CO1: Define vehicle-to-x (v2x) communication

CO2: Solve specific problems with standards and technologies

CO3: Gain knowledge of the basics wireless propagation and channel characteristics

CO4: Review on Medium Access Control (MAC)

CO5: Explain about vehicular networks

19CAOE16 ENERGY EFFICIENT LIGHTING SYSTEM

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the importance of lightning.
- To known the fundamentals of illumination and its methods.
- To familiar lighting control methods for various applications.
- To understand energy efficient lighting in building management system.
- To study the renewable energy methods for energy efficient lighting.

UNIT- I :LIGHTING **9**

Lighting - Importance of lighting in buildings - Interior designing, Photography, Architecture - Difference between good and bad lighting - Challenges in lighting - Types of lighting.

UNIT- II : ILLUMINATION FUNDAMENTALS & VARIOUS ILLUMINATION METHODS **9**

Introduction - Terms used in illumination - Laws of illumination - Polar curves - Photometry - Integrating sphere - Sources of light - Discharge lamps - Incandescent lamps - MV and SV lamps.

UNIT- III: ENERGY EFFICIENT LIGHTING **9**

Smart lighting - Fluorescent lamps - Comparison between Tungsten filament lamps and Fluorescent tubes - Basic principles of light control - Types and design of lighting and flood lighting - CFL - LED - High Intensity Discharge lamps.

UNIT- IV: BUILDING MANAGEMENT SYSTEM **9**

Energy efficient landscape design - Natural lighting - Choice of building materials for energy efficient lighting - Light pipes - Light fixtures - Green buildings - Construction techniques.

UNIT- V: CASE STUDY **9**

Solar lighting techniques - Lighting using wind power - Energy conservation building code - Energy efficient buildings in the country.

Contact Periods:

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

REFERENCES:

1. Philip Gordon., "Principles and Practices of Lighting Design: The Art of Lighting Composition", Blue Matrix Productions, 2011.
2. Jerry Yudelson, "Green Building Through Integrated Design" The McGraw - Hill Companies, Inc., 2009.
3. Derek Phillips, "Daylighting: Natural Light in Architecture", Elsevier, 2004.
4. Jerry Yudelson , "Greening Existing Buildings", The McGraw - Hill Companies, Inc.,1st Edition, 2010.
5. Sam Kubba,"Handbook of Green Building Design and Construction", Elsevier Inc., 2012.
6. Solanki.C.S, "Solar Photovoltaic Technology and Systems", PHI, 2013.
7. J. F. Manwell, J.G. MC Gowan and A.L. Rogers, "Wind Energy Explained: Theory, Design and Application", Wiley, 2ndEdition, 2010.

COURSE OUTCOMES:

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

CO1: Understand the properties of light, importance of lighting in various fields and types of lighting

CO2: Understand the properties and laws of illumination, working of discharge lamps, fluorescent lamps, tungsten filament lamps and light control techniques

CO3: Compare the various lighting techniques and employ suitable lighting control methods for various applications

CO4: Choose the building materials and construction techniques for energy efficient lighting

CO5: Employ renewable energy methods for energy efficient lighting

19CAOE17	SENSORS AND TRANSDUCERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of measurement technology.
- To learn the various motion, proximity and ranging sensors used to measure various physical parameters.
- To understand the various force, magnetic and heading sensors used to measure various physical parameters.
- To know the various optical, pressure and temperature sensors used to measure various physical parameters.
- To understand the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT- I :INTRODUCTION 9

Basics of measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor output signal types.

UNIT- II :MOTION, PROXIMITY AND RANGING SENSORS 9

Motion sensors – Potentiometers, resolver, encoders – Optical, magnetic, inductive, capacitive, LVDT – RVDT – Synchro – Microsyn, accelerometer – GPS, bluetooth, Range sensors – RF beacons, Ultrasonic ranging, Reflective beacons, Laser range sensor (LIDAR).

UNIT- III :FORCE, MAGNETIC AND HEADING SENSORS 9

Strain gage, Load cell, Magnetic sensors – Types, principle, requirement and advantages: Magneto resistive – Hall effect – Current sensor, Heading sensors – Compass, gyroscope, inclinometers.

UNIT- IV :OPTICAL, PRESSURE AND TEMPERATURE SENSORS 9

Photo conductive cell, Photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, bellows, Piezoelectric – Tactile sensors, Temperature – IC, thermistor, RTD, thermocouple. Acoustic Sensors – Flow and level measurement, Radiation sensors – Smart Sensors – Film sensor, MEMS & Nano sensors, LASER sensors.

UNIT- V :SIGNAL CONDITIONING and DAQ SYSTEMS 9

Amplification – Filtering – Sample and hold circuits – Data acquisition: single channel and multi channel data acquisition – Data logging – Applications – Automobile, aerospace, Home appliances, Manufacturing, Environmental monitoring.

Contact Periods:

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

REFERENCES:

1. Ernest O. Doebelin, “Measurement Systems - Applications and Design”, Tata McGraw-Hill, 2009.
2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th Edition, Dhanpat Rai & Co, New Delhi, 2013.
3. Patranabis D., “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2010.

4. John Turner and Martyn Hill, “Instrumentation for Engineers and Scientists”, Oxford Science Publications, 1999.
5. Richard Zurawski, “Industrial Communication Technology Handbook” 2nd Edition, CRC Press, 2015.

COURSE OUTCOMES:

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

CO1: Expertise in various calibration techniques and signal types for sensors
CO2: Apply the various sensors in the automotive and mechatronics applications
CO3: Study the basic principles of various magnetic sensors
CO4: Study the basic principles of various smart sensors
CO5: Implement the DAQ systems with different sensors for real time applications

19CAOE18	ELECTRICAL SAFETY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify the presence of electrical hazards and measures to minimize risks.
- To determining the cause of electrical accidents, fires and explosions.
- To apply various grounding and bonding techniques.
- To adequate safety method for low, medium and high voltage equipment.
- To know the various fundamentals and provide solutions to a practical case study.

UNIT- I :INTRODUCTION AND HAZARDS OF ELECTRICITY 9

Introduction – Hazard analysis: Primary and secondary hazards – Arc, blast, shocks – Causes and effects – Summary of causes – Protection and precaution – Injury and death protective strategies – IE Rules 1956 – Basic rules for new installations: Power system, domestic and industry (Qualitative treatment only).

UNIT- II : ELECTRICAL SAFETY EQUIPMENT 9

General inspection and testing procedure for electrical safety equipment – Electrical safety equipment for external protection: Flash and thermal protection – Head and eye protection – Insulation protection. Electrical safety equipment for internal protection: Over voltage, short circuit, earth fault, leakage current, high/low frequency – Single line diagram of industrial power system with safety control – Electrician's safety kit and materials.

UNIT- III : SAFETY PROCEDURES 9

Introduction – Six-step safety method – Job briefings – Energized or De-energized – Safe switching of power systems – General energy control programs – Lockout – Tag out – Voltage measurement techniques – Placement of safety grounds – Flash hazard calculations and approach distances – Calculating the required level of arc protection (flash hazard calculations) – Barriers and warning signs – Tools and test equipment – Field marking of potential hazards – Shock avoidance techniques – One-minute safety audit.

UNIT- IV : GROUNDING AND ELECTRICAL MAINTENANCE 9

Need for electrical equipment grounding – System grounding – Equipment grounding – Types of Earthing – Earth testing for electrical equipment's in power house and industry – Eight step maintenance program – Maintenance requirements for specific equipment and location – IEC and UL standard.

UNIT- V : VOLTAGE SAFETY SYNOPSIS AND MEDICAL SAFETY MANAGEMENT 9

Safety equipment's and safety procedures for low voltage and high voltage system – Electrical safety around electronic circuits – Electrical safety for medical equipment like over current safety, isolation, EMI and harmonics – Battery maintenance procedure – Stationary battery safety – Accident prevention – Accident investigation – First aid – Rescue techniques – Electrical safety program structure and development – Safety meetings – Safety audits.

Contact Periods:

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

REFERENCES:

1. John Cadick, Mary Capelli-Schellpfeffer and Dennisneitzel, "Electrical Safety Handbook", Mcgraw Hill Publishing Company Ltd., 4th Edition, 2012.
2. Dennis Neitzel and Al Winfield, "Electrical Safety Handbook", McGraw – Hill Education, 4th Edition, 2012.
3. Mohamed A El-Sharkawi, "Electric safety: Practice and Standards", CRC press, New York, 2013.
4. Martha J. Boss and Gayle Nicoll, "Electrical Safety: Systems, Sustainability and Stewardship", CRC press, New York, 2014.
5. Ray A. Jones and Jane G. Jones, "The Electrical Safety Program Guide", National fire protection association, Quincy, 2011.
6. James H and Wiggins JR., "Managing Electrical Safety", Abs Consulting, Maryland, 2011.

COURSE OUTCOMES:

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

CO1: Expand skills in identifying the presence of electrical hazards, implementing measures to minimize risks

CO2: Develop skills in investigative techniques for determining the cause of electrical accidents, fires and explosions

CO3: Analyze and apply various grounding and bonding techniques

CO4: Select appropriate safety method for low, medium and high voltage equipment.

CO5: Assess and provide solutions to a practical case study

19CAOE19	ELECTRIC VEHICLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To anderstand the basics of electric vehicle components and configuration.
- To analyze suitable drive scheme for developing an electric trains.
- To analyze energy storage system.
- To identify a energy management system.
- To understand the infrastructure for electric vehicles and business potential.

UNIT- I: INTRODUCTION **9**

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**

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**

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**

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**

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

REFERENCES:

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. Mi C, Masrur M A and Gao D W., “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2017.
3. Onori S, Serrao L and Rizzoni G., “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
4. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Butterworth - Heinemann, 2002.
5. Ronald K. Jurgen, “Electric and Hybrid - Electric Vehicles”, SAE, 2010.

COURSE OUTCOMES:

Upon completion of this course, the 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: Analyze a proper energy storage system
CO4: Opt a proper energy management system
CO5: Understand the infrastructure for electric vehicles and business potential

19CAOE20	SCADA SYSTEM AND APPLICATION MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge about the SCADA system.
- To provide knowledge about the SCADA components.
- To grasp knowledge about SCADA communication.
- To understand the concepts of SCADA monitoring and control.
- To understand the concepts of SCADA application in power system.

UNIT- I :INTRODUCTION TO SCADA **9**

Evolution of SCADA, SCADA definitions, SCADA functional requirements and components, SCADA hierarchical concept, SCADA architecture, General features, SCADA applications, benefits.

UNIT- II :SCADA SYSTEM COMPONENTS **9**

Remote terminal unit (RTU), Interface units, human-machine interface units (HMI), Display monitors/data logger systems, Intelligent electronic devices (IED), Communication network, SCADA server, SCADA control systems and control panels.

UNIT- III :SCADA COMMUNICATION **9**

SCADA communication requirements, Communication protocols: Past, present and future, structure of a SCADA communications protocol, Comparison of various communication protocols, IEC61850 based communication architecture, Communication media like fiber optic, PLCC etc. Interface provisions and communication extensions, Synchronization with NCC, DCC.

UNIT- IV :SCADA MONITORING AND CONTROL **9**

Online monitoring the event and alarm system, Trends and reports, Locking list, Event disturbance recording. Control function: Station control, Bay control, Breaker control and disconnector control.

UNIT- V :SCADA APPLICATIONS IN POWER SYSTEM **9**

Applications in generation, Transmission and distribution sector, Substation SCADA system functional description, System specification, system selection such as substation configuration, IEC61850 ring configuration, SAS cubicle concepts, Gateway interoperability list, Signal naming concept. System installation, Testing and commissioning.

Contact Periods:

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

REFERENCES:

1. Stuart A. Boyer, "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications,USA, 2016.
2. Gordon Clarke, Deon Reynders, "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK, 2004.
3. William T. Shaw, "Cybersecurity for SCADA Systems", PennWell Books, 2006.
4. David Bailey and Edwin Wright, "Practical SCADA for Industry", Newnes, 2003.
5. Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT Systems for

Electric Power", PennWell 1999.
6. Dieter K. Hammer, Lonnie R. Welch and Dieter K. Hammer, "Engineering of Distributed Control Systems", Nova Science Publishers, USA, 1st Edition, 2002.

COURSE OUTCOMES:

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

CO1: Understand the concepts of SCADA system
CO2: Acquire knowledge about the SCADA components
CO3: Acquire knowledge about SCADA communication
CO4: Understand the concepts of SCADA monitoring and control
CO5: Understand the concepts of SCADA application in power system

19CAOE21	TESTING OF MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply knowledge of mechanics of materials for designing mechanical elements including design process, failure prevention under static & variable loadings.

UNIT- I: INTRODUCTION **6**

Strength of materials – Basic assumptions – Elastic and plastic behaviour – Average stress and strain – Concept of stress, Strain and the types of stresses and strains.

UNIT- II: PLASTIC DEFORMATION OF CRYSTALS **9**

Deformation by slip – Slip in a perfect lattice – Slip by dislocation movement – Critical resolved shear stress for slip – Deformation of single crystals – Polycrystalline materials – Deformation by twinning, stacking faults, strain hardening.

UNIT- III: FRACTURE MECHANICS AND HARDNESS TESTING **12**

Types of fracture, Griffith theory and modified Griffith – Orowan theory, metallographic aspects of fracture, crack propagation, concept of fracture curve. Concept of fracture curve – Fracture toughness KIC Testing. R-curve, J-Integral, drop weight test – Brinell hardness testing, Rockwell hardness testing, Vickers hardness testing and knoop hardness testing, Nano indentation, Problems.

UNIT- IV: TENSION TESTING **9**

ASTM Standards and specification, Engineering stress & strain, True stress strain curves, Holloman – Ludwig equation – Plastic Instability (Necking) – Testing machines – Types, testing procedures, Properties measured, Specimen dimensions, Problems.

UNIT-V: TORSION, SHEARING AND IMPACT TEST **9**

ASTM Standards and specification Testing Machines and procedures. Impact testing: Principle – Izod and Charpy Impacts tests, ASTM Standards and specification. Ductile to Brittle Transition Temperature (DBTT), Factors affecting DBTT – Determination of DBTT.

Contact periods:

Lecture: 45 Periods Lecture: 45 Periods Lecture: 45 Periods Lecture: 45 Periods

REFERENCES:

1. George E. Dieter, “Mechanical Metallurgy” 3rd Edition, Mc Graw Hill, 2013.
2. Hull D and Bacon D J., “Introduction to dislocations”, Butterworth Heinemann, Oxford, 2001.
3. Wullf et al, Vol. III “Mechanical Behavior of Materials", John Wiley and Sons, New York,1983.

COURSE OUTCOMES:

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

CO1: Understand the static force and inertia forces and their effect that exist in materials
CO2: Perform balancing, vibration and critical speeds with respect to material
CO3: Understand the standards, concepts and terminology of material testing
CO4: Select the appropriate measuring device based on measuring requirements
CO5: Gain knowledge regarding impacts and testing of materials

19CAOE22	ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the functions of the basic components of a robot.
- To study the use of various types of end effectors and sensors.
- To impart knowledge in robot kinematics and programming.
- To learn robot safety issues and economics.

UNIT-I: FUNDAMENTALS OF ROBOT **9**

Robot – Definition – Robot anatomy – Coordinate systems, Work envelope, Types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of motion, Pay load – Robot parts and their functions – Need for robots – Different applications.

UNIT-II: ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**

Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – D.C. Servo motors, Stepper motors, A.C. Servo motors – Salient features, Applications and comparison of all these drives, End effectors – Grippers – Mechanical grippers, Pneumatic and hydraulic grippers, Magnetic grippers, Vacuum grippers; Two fingered and Three fingered grippers; Internal grippers and external grippers; Selection and design considerations.

UNIT- III: SENSORS AND MACHINE VISION **9**

Requirements of a sensor, Principles and Applications of the following types of sensors – Position sensors – Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors, Range sensors – Triangulations principles, Structured, Lighting approach, Time of flight, Range finders, Laser range meters, Touch sensors, Binary sensors., Analog sensors, Wrist sensors, Compliance sensors, Slip sensors, Camera, Frame grabber, Sensing and Digitizing image data – Signal conversion, Image storage, Lighting techniques, Image processing and analysis – Data deduction, Segmentation, Feature extraction, Object recognition, Other algorithms, Applications – Inspection, Identification, Visual serving and navigation.

UNIT-IV: ROBOT KINEMATICS AND ROBOT PROGRAMMING **9**

Forward kinematics, Inverse kinematics and Difference; Forward kinematics and Reverse kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of Freedom (in 3 Dimension) Jacobians, Velocity and Forces – Manipulator dynamics, Trajectory generator, Manipulator mechanism design – Derivations and Problems. Lead through programming, Robot programming languages – VAL Programming – Motion commands, Sensor commands, End effectors commands and Simple programs.

UNIT-V: IMPLEMENTATION AND ROBOT ECONOMICS **9**

RGV, AGV; Implementation of robots in industries – Various steps; Safety considerations for robot operations – Economic analysis of robots.

Contact periods:

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

REFERENCES:

1. Groover M P., “Industrial Robotics – Technology Programming and Applications”, McGraw Hill, 2012.
2. Klafter R D., Chmielewski T A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003.
3. Craig JJ. “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.
4. Deb S R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 2013.
5. Fu.KS, Gonzalz R C and Lee C S G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
6. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 1995.
7. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co., 1992.

COURSE OUTCOMES:

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

CO1: Explain the concepts of industrial robots, classification, specifications and coordinate systems. Also summarize the need and application of robots in different sectors

CO2: Illustrate the different types of robot drive systems as well as robot end effectors

CO3: Apply the different sensors and image processing techniques in robotics to improve the ability of robots

CO4: Develop robotic programs for different tasks and familiarize with the kinematics motions of robot

CO5: Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots

19CAOE23	INDUSTRIAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To assume Technical and Managerial roles in the Industries.
- To apply Engineering Principles to the working environment.
- To use quality tools to foresee and solve issues in the industrial situations.
- To work collaboratively.

UNIT-I: FORECASTING **9**

Characteristics and principles – Qualitative methods, Delphi technique, Market research – Time series methods – Moving average, Exponential smoothing, Box Jenkins method – Autoregressive moving average (ARMA) or autoregressive integrated moving average (ARIMA) models – Fitting regression models – Measurement of forecast errors, Coefficient of correlation – Problem solving.

UNIT-II: FACILITIES PLANNING AND WORK STUDY **9**

Factors affecting site location decisions – Principles and types of layout – Layout planning – Layout tools and computerized layout techniques – Design of group technology layout – Line balancing – Line balancing methods – Objectives of work study – Method study procedure, Recording techniques – Motion study – Principles of motion Economy – Techniques of work measurement – Time study – Synthesis method – Analytical estimating – Predetermined Motion Time System (PMTS) – Work sampling techniques.

UNIT- III: LEAN MANUFACTURING **9**

Elements of Just In Time (JIT) – Pull and push system, Kanban system – Optimized production technology and synchronous manufacturing – Implementation of Six sigma – Single Minute Exchange of Die (SMED) 5S concept – Concurrent engineering – Cellular manufacturing – Enablers of agile manufacturing – Rapid manufacturing - Business Process Reengineering (BPR) – Enterprises Resources Planning (ERP) – Role of KAIZEN, Quality circles and POKA YOKE in modern manufacturing – Seven wastes in lean manufacturing.

UNIT-IV: AGGREGATE PRODUCTION PLANNING **9**

Objectives of aggregate planning – Capacity Requirement Planning (CRP) process – Types of capacity planning – Strategies for aggregate capacity planning – Master production scheduling – Procedure for developing MPS – Materials Requirements Planning (MRP-I), Issues in MRP, Designing and Managing the MRP System, Evaluation of MRP – Manufacturing Resources Planning (MRP-II).

UNIT-V: SCHEDULING OF OPERATIONS **9**

Operations planning and scheduling – Scheduling techniques – Stages in scheduling – Loading, dispatching, Expediting – Finite loading and infinite loading – Load charts and machine loading charts – Priority sequencing – Dynamic sequencing rules – Batch scheduling – Economic Batch Quantity (EBQ) or Economic Run Length (ERL) – Scheduling in repetitive, Batch and job shop manufacturing – Allocation of units for a single resource, Allocation of multiple resources – Resource balancing - Flexible manufacturing system.

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

REFERENCES:
1. Panneerselvam R., "Production & Operations Management", 3rd Edition, PHI Learning Private Limited, New Delhi, 2012.
2. Elwood S. Buffa, and Rakesh K. Sarin, "Modern Production/Operation Management", 8th Edition, John Wiley & Sons, 2000.
3. Dilworth B. James, "Operations Management Design, Planning and Control for Manufacturing and Services", Mcgraw Hill Inc., New York, 1992.
4. Vollman TE., "Manufacturing Planning and Control Systems", Galgotia Publications, 2002.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Apply the knowledge of Engineering and Sciences to improve the productivity of industries
CO2: Design a system to meet the desired needs within realistic constraints
CO3: Function in multidisciplinary teams
CO4: Use the techniques, skills, and modern Engineering tools in manufacturing practice
CO5: Perform as an effective industrial Engineer integrating high and low levels of management

19CAOE24	MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart elementary knowledge to the students regarding the various aspects of sales management.

UNIT- I: SALESMANSHIP **9**

Meaning, Definition, Characteristics, Concept, Kinds, Nature – Evolution, and psychology in selling, Scope, Limitations and importance – Sales management: meaning, definition, Characteristics, Principles, Functions and importance, Difference between sales management and marketing management.

UNIT-II: SALESMAN **9**

Types, Qualities, Objectives, Duties and responsibilities of good salesman, Recruitment, selection and training of salesman: Sources of recruitment, Principles of selection, Selection procedure, Meaning, Advantages, Disadvantages, Methods, Principles and limitation, Subject matter and Types of good training programme.

UNIT- III: REMUNERATION/ COMPENSATION **9**

Essentials of Good Remuneration Plan, Objectives – Methods, Factors determining Remuneration Plan, Comparative study of various plans. Motivating sales force: Meaning, Definition, Objectives, Importance and methods.

UNIT-IV: SALES PLANNING **9**

Meaning, Components, Elements, Types, Importance and limitations, Sales fields or territories: Meaning, Definition, Objectives, Factors determining Size, Allocation of sales territories, Steps in setting sales territories. Sales quota: Meaning, Definition, Objectives, Factors determining sales quota, Methods of determining sales quota, Types, Principles of successful sales quota, Advantages and disadvantages of sales quota.

UNIT-V: CONSUMER BEHAVIOUR **9**

Meaning, Definition, Variables and factors affecting Consumer behaviour – Buying Motives: Meaning, Kinds, Chief buying motives – Different types of consumers – Behaviour and customer service.

Contact periods:

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

REFERENCES:

1. Santoki, "Sales Management", Kalyani Publisher.
2. Gupta S L., "Sales and Distribution Management", Excel Books, New Delhi, 2008.
3. Still R and Richard, "Sales Management", Pearson Prentice Hall, Delhi.
4. Schiffman, Kanuk and Kumar, "Consumer Behaviour", Pearson, 10th Edition.
5. Kotler and Keller, "Marketing Management", Pearson Publication.

COURSE OUTCOMES:

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

CO1: Understand the concepts for salesmanship

CO2: Developed knowledge of salesman responsibilities
CO3: Understand the concepts for remuneration and compensation methods
CO4: Developed knowledge of sales planning techniques
CO5: Understand the use of consumer behavior concepts

19CAOE25	ENERGY CONSERVATION AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study about the energy data, energy accounting and balancing of industries.

UNIT-I: INTRODUCTION **9**

Energy – Power – Past & present scenario of world; National energy consumption data – Environmental aspects associated with energy utilization – Energy auditing: Need, Types, Methodology and barriers. Role of energy managers. Instruments for energy auditing.

UNIT-II: ELECTRICAL SYSTEMS **9**

Components of EB billing – HT and LT supply, Transformers, Cable sizing, Concept of capacitors, Power factor improvement, Harmonics, Electric motors – Motor efficiency Computation, Energy efficient motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED lighting and scope of Encon in illumination.

UNIT-III: THERMAL SYSTEMS **9**

Stoichiometry, Boilers, Furnaces and thermic fluid heaters – Efficiency computation and Encon measures. Steam: Distribution & usage: Steam traps, Condensate recovery, Flash steam utilization, Insulators & refractories.

UNIT-IV: ENERGY CONSERVATION IN MAJOR UTILITIES **9**

Pumps, Fans, Blowers, Compressed air systems, Refrigeration and air conditioning Systems – Cooling towers – D.G. sets.

UNIT-V: ECONOMICS **9**

Energy economics – Discount rate, Payback period, Internal rate of return, Net present Value, Life cycle costing – ESCO concept.

Contact periods:

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

REFERENCES:

1. Witte LC, Schmidt P S and Brown D R., "Industrial Energy Management and Utilisation", Hemisphere Publ, Washington, 1988.
2. Callaghn P W., "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.
3. Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.
4. Dryden I G C., "The Efficient Use of Energy", Butterworths, London, 1982.
5. Turne W C., "Energy Management Hand book", Wiley, New York, 1982.
6. Murphy W R and Mc KAY G., "Energy Management", Butterworths, London 1987.

COURSE OUTCOMES:

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

CO1: Understand the significance and procedure for energy conservation and audit
CO2: Analyze, Calculate and Improve the energy efficiency and performance of electrical utilities
CO3: Analyze, Calculate and Improve the energy efficiency and performance of thermal utilities
CO4: Analyze, Calculate and Improve the energy efficiency and performance of mechanical utilities
CO5: Carry out the energy accounting and balancing

19CEVA$01	SURVEYING USING TOTAL STATION	L	T	P	C
		5	0	10	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To acquire complete knowledge on Total Station and to carry out surveying using Total Station.

UNIT-I: INTRODUCTION TO TOTAL STATION **5**

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**

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**

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: 5 Periods Tutorial: 0 Periods Practical: 10 Periods Total: 15 Periods

COURSE OUTCOMES:

Upon completion of this course, the students 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 ferment or and its ancillaries

CO4: Learn the production of various primary and secondary metabolites

CO5: Understand the production of biotechnological products

19CEVA$02	ENVIRONMENTAL AUDIT	L	T	P	C
		10	0	5	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**

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**

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**

Applications of EMS - Waste Audits and Pollution Prevention opportunities in Textile, Sugar, Pulp & Paper, Electroplating, Tanning industry, Dairy, Cement, Chemical industries.

Contact periods:
Lecture: 10 Periods Tutorial: 0 Periods Practical: 5 Periods Total: 15 Periods

REFERENCES:

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.

COURSE OUTCOMES:

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

CO1: Gaining knowledge about the objectives and types of environmental audit

CO2: Understanding Environmental audit procedures and implementation

19CEVA$03	YOGA FOR YOUTH EMPOWERMENT	L	T	P	C
		5	0	10	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

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

Rules & Regulations - asana, pranayama, mudra, bandh.

UNIT III: MIND 5

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: 5 Periods Tutorial: 0 Periods Practical: 10 Periods Total: 15 Periods

REFERENCES:

1. "Yoga for Modern Age" –Vethathiri Maharishi.
2. "Mind" –Vethathiri Maharishi.

COURSE OUTCOMES:

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

CO1: YOGA which gives healthy & better living, Physical, Mental strength, Intellectual & spiritual

CO2: Work skill fully and perfectly towards the excellence

19CEVA$04	VALUATION	L	T	P	C
		10	0	5	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To understand principle of valuation
- To determine the depreciation of any property
- Evaluate the actual value of any property

UNIT- I: COST, PRICE AND VALUE **5**

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.

UNIT- II: DEPRECIATION **5**

Meaning of the term - Depreciation as cost in operation - Depreciation as decrease in worth - Physical conditions - Difference between depreciation and obsolescence - Methods for estimating cost depreciation - Cost depreciation and value depreciation - Depreciation and depletion.

UNIT- III: METHODS OF VALUATION **5**

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 - Valuation of Licensed Premises.

Contact periods:
Lecture: 10 Periods Tutorial: 0 Periods Practical: 5 Periods Total: 15 Periods

REFERENCES:

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:

Upon completion of this course, the students will be able to
CO1: Explain principle of valuation and cost
CO2: Calculate depreciation of any property
CO3: Evaluate the actual value of any property

19CEVA$05	DESIGN OF MULTI STOREY BUILDING	L	T	P	C
		15	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To draw the plan, analyse and design a multi storey building

UNIT- I: INTRODUCTION **5**

Planning – BIS recommendations – Detailed plan – Structural plan – Manual sketch – Computer Aided Drawing – IS codes.

UNIT- II: ANALYSIS AND DESIGN **10**

Design of One way and Two way slab – Design of lintel cum sunshade – Staircase – Detailed drawings

Beam: Load analysis – Frame analysis – Two cycle method – Beam design – Detailed drawings.

Column: Load Analysis – Uni axial and Bi axial bending – Slender column – Detailed drawings.

Foundation: Load Analysis – Design – Check for shear – Detailed drawings.

Contact periods:
Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Know about the codes and standards of the building drawing
CO2: Design the different structural elements
CO3: Analyse the column beam and foundation

19CEVA$06	CIVIL ENGINEERING - SOCIETAL AND GLOBAL IMPACT	L	T	P	C
		5	0	10	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To give 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 **5**

Development of Pre-industrial revolution up to Industry4.0 - Construction4.0. Modern Building Materials: Ceramic Materials - common ceramic materials & their characteristics - Ceramic matrix composites and their applications– Neoprene.

UNIT- II: INFRASTRUCTURE **5**

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.

UNIT- III: CIVIL ENGINEERING PROJECTS **5**

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: 5 Periods Tutorial: 0 Periods Practical: 10 Periods Total: 15 Periods

REFERENCES:

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 DevelopingWorld", 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:

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

CO1: Able to know the Development of Pre-industrial revolution and Modern Building Materials features & their applications

CO2: Acquire knowledge in Sustainability of the Environment, including its Aesthetic

CO3: Understand the impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively