



VELS



INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI

ACCREDITED BY **NAAC** WITH '**A**' GRADE
*Marching Beyond **30** Years Successfully*

B.E. Civil Engineering

Curriculum and Syllabus 2022

**(Based on Choice Based Credit System (CBCS)
and
Outcome Based Education (OBE))
Effective from the Academic year
2022-2023**

**Department of Civil Engineering
School of Engineering**

VISION OF THE CIVIL ENGINEERING DEPARTMENT

To achieve national and international recognition by becoming a collaborative centre for learning & innovation and preparing the engineers to be stewards of a sustainable society by enhancing their innovative spirit, developing their professional and leadership qualities to face the challenges of the society and provide sustainable solutions

MISSION OF THE CIVIL ENGINEERING DEPARTMENT

- i. To train the students by disseminating the knowledge of engineering, science and technology through in plant trainings, internships, value added courses and industrial visits
- ii. To assist the students in discovering their talents and skills to become experts/entrepreneurs in solving the contemporary issues of civil engineering
- iii. To equip the students with relevant sustainable and engineering approaches to the built and natural environment by raising their professional and leadership qualities for creating a sustainable society
- iv. To motivate the students to pursue higher education and compete at the global level
- v. To collaborate with leading industrial organizations and educational institutions in India and abroad for creating centers of excellence in emerging areas of Civil engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

After the completion of the program, the civil engineering graduates will be able to

- PEO I** Exhibit greater level of technical competence and shine in their careers by applying knowledge in mathematical, scientific and engineering fundamentals.
- PEO II** Inculcate the lifelong learning abilities to gain multi-disciplinary knowledge in developing safe, sustainable, economical and environmentally sound solutions to societal problems with social awareness and responsibility
- PEO III** Demonstrate competency in using contemporary tools and techniques to meet the changing needs of nation and society at large
- PEO IV** Develop economically viable, sustainable solutions to diverse civil engineering problems either within the profession or through post-graduate research by effectively communicating the civil engineering concepts orally and in written forms

PROGRAMME OUTCOMES (PO)

Graduates in Civil Engineering will acquire and possess ability to

- PO 1 Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex civil engineering problems
- PO 2 Problem Analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO 3 Design/development of solutions:** Design solutions for complex civil engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
- PO 4 Investigations on 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.
- PO 5 Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- PO 6 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.
- PO 7 Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.
- PO 8 Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO 9 Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- PO 10 Communication:** Communicate effectively on complex engineering activities with the engineering community and with the 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.
- PO 11 Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO 12 Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OBJECTIVES (PSO)

At the completion of programme, civil engineering graduates will

- PSO I** Design, analyze and execute a civil engineering problem by demonstrating technical competence in the fields of structural, geotechnical, seismic, transportation, environmental and design of civil structures to meet the needs of the industry/client
- PSO II** Apply modern management and construction techniques to design/create sustainable and smart solutions within the stipulated time and funds

COMPETENCIES & PERFORMANCE INDICATORS

PO 1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex civil engineering problems			
Competency		Performance Indicators	
1.1	Demonstrate competence in mathematical modelling	1.1.1	Apply mathematical techniques such as calculus, multivariable calculus, linear algebra, differential equations, Fourier series, probability and statistics to solve problems
		1.1.2	Apply advanced mathematical techniques to model and solve civil engineering problems
1.2	Demonstrate competence in basic sciences	1.2.1	Apply laws of natural science to an engineering problem
1.3	Demonstrate competence in engineering fundamentals	1.3.1	Apply fundamental engineering concepts to solve engineering problems
1.4	Demonstrate competence in specialized engineering knowledge to the program	1.4.1	Apply basic civil engineering concepts to solve engineering problems.
PO 2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.			
Competency		Performance Indicators	
2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.1.1	Articulate problem statements and identify objectives
		2.1.2	Identify engineering systems, variables, and parameters to solve the problems
		2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2	Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1	Reframe complex problems into interconnected sub-problems
		2.2.2	Identify, assemble and evaluate information and resources
		2.2.3	Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions
		2.2.4	Compare and contrast alternative solution processes to select the best process

2.3	Demonstrate an ability to formulate and interpret a model	2.3.1	Combine scientific principles and engineering concepts to formulate model/s (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy
		2.3.2	Identify assumptions (mathematical and physical) necessary to allow modeling of a system at the level of accuracy required.
2.4	Demonstrate an ability to execute a solution process and analyze results	2.4.1	Apply engineering mathematics and computations to solve mathematical models
		2.4.2	Produce and validate results through skillful use of contemporary engineering tools and models
		2.4.3	Identify sources of error in the solution process, and limitations of the solution
		2.4.4	Extract desired understanding and conclusions consistent with objectives and limitations of the analysis
PO 3: Design/development of solutions: Design solutions for complex civil engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.			
Competency		Performance Indicators	
3.1	Demonstrate an ability to define a complex/ open- ended problem in engineering terms	3.1.1	Recognize that need analysis is key to good problem definition
		3.1.2	Elicit and document, engineering requirements from stakeholders
		3.1.3	Synthesize engineering requirements from a review of the state-of-the-art
		3.1.4	Extract engineering requirements from relevant engineering Codes and Standards such as ASCE, IRC, ASTM, BIS, ISOand NBC
		3.1.5	Explore and synthesize engineering requirements considering health, safety risks, environmental, cultural and societal issues
		3.1.6	Determine design objectives, functional requirements and arrive at specifications
3.2	Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1	Apply formal idea generation tools to develop multiple engineering design solutions
		3.2.2	Build models/prototypes to develop a diverse set of design solutions
		3.2.3	Identify suitable criteria for the evaluation of alternate design solutions
3.3	Demonstrate an ability to select an optimal design scheme for further development	3.3.1	Apply formal decision-making tools to select optimal engineering design solutions for further development
		3.3.2	Consult with domain experts and stakeholders to select engineering design solution for further development

3.4	Demonstrate an ability to advance an engineering design to defined end state	3.4.1	Refine a conceptual design into a detailed design within the existing constraints (of the resources)
		3.4.2	Generate information through appropriate tests to improve or revise the design
PO 4: Investigations on 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.			
Competency		Performance Indicators	
4.1	Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1	Define a problem, its scope and importance for purposes of investigation
		4.1.2	Examine the relevant methods, tools and techniques of experiment design, system calibration, data acquisition, analysis and presentation
		4.1.3	Apply appropriate instrumentation and/or software tools to make measurements of physical quantities
		4.1.4	Establish a relationship between measured data and underlying physical principles.
4.2	Demonstrate an ability to design experiments to solve open-ended problems	4.2.1	Design and develop an experimental approach, specify appropriate equipment and procedures
		4.2.2	Understand the importance of the statistical design of experiments and choose an appropriate experimental design plan based on the study objectives
4.3	Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1	Use appropriate procedures, tools and techniques to conduct experiments and collect data
		4.3.2	Analyze data for trends and correlations, stating possible errors and limitations
		4.3.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions
		4.3.4	Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions
PO 5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.			
Competency		Performance Indicators	
5.1	Demonstrate an ability to identify/ create modern engineering tools, techniques and resources	5.1.1	Identify modern engineering tools such as computer-aided drafting, modeling and analysis; techniques and resources for engineering activities
		5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems

5.2	Demonstrate an ability to select and apply discipline-specific tools, techniques and resources	5.2.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
		5.2.2	Demonstrate proficiency in using discipline-specific tools
5.3	Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1	Discuss limitations and validate tools, techniques and resources
		5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.
PO 6: 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.			
Competency		Performance Indicators	
6.1	Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level
6.2	Demonstrate an understanding of professional engineering regulations, legislation and standards	6.1.2	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public
PO 7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.			
Competency		Performance Indicators	
7.1	Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.1.1	Identify risks/impacts in the life-cycle of an engineering product or activity
		7.1.2	Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability
7.2	Demonstrate an ability to apply principles of sustainable design and development	7.2.1	Describe management techniques for sustainable development
		7.2.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline
PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.			
Competency		Performance Indicators	
8.1	Demonstrate an ability to recognize ethical dilemmas	8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives
8.2	Demonstrate an ability to apply the Code of Ethics	8.2.1	Identify tenets of the ASCE professional code of ethics
		8.2.2	Examine and apply moral & ethical principles to known case studies

PO 9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Competency		Performance Indicators	
9.1	Demonstrate an ability to form a team and define a role for each member	9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
		9.1.2	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.
9.2	Demonstrate effective individual and team operations-- communication, problem-solving, conflict resolution and leadership skills	9.2.1	Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
		9.2.2	Treat other team members respectfully
		9.2.3	Listen to other members
		9.2.4	Maintain composure in difficult situations
9.3	Demonstrate success in a team-based project	9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the 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.

Competency		Performance Indicators	
10.1	Demonstrate an ability to comprehend technical literature and document project work	10.1.1	Read, understand and interpret technical and non-technical information
		10.1.2	Produce clear, well-constructed, and well-supported written engineering documents
		10.1.3	Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.2	Demonstrate competence in listening, speaking, and presentation	10.2.1	Listen to and comprehend information, instructions, and viewpoints of others
		10.2.2	Deliver effective oral presentations to technical and non-technical audiences
10.3	Demonstrate the ability to integrate different modes of communication	10.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations
		10.3.2	Use a variety of media effectively to convey a message in a document or a presentation

PO 11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Competency		Performance Indicators	
11.1	Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1	Describe various economic and financial costs/benefits of an engineering activity
		11.1.2	Analyze different forms of financial statements to evaluate the financial status of an engineering project

11.2	Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.2.1	Analyze and select the most appropriate proposal based on economic and financial considerations
11.3	Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.3.1	Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks.
		11.3.2	Use project management tools to schedule an engineering project, so it is completed on time and on budget
PO 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.			
Competency		Performance Indicators	
12.1	Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1	Describe the rationale for the requirement for continuing professional development
		12.1.2	Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
12.2	Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1	Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current
		12.2.2	Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
12.3	Demonstrate an ability to identify and access sources for new information	12.3.1	Source and comprehend technical literature and other credible sources of information
		12.3.2	Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

Members of Board of Studies

Internal Members

1	Dr T Ilango	HOD & Chair person	Vels University
2	Dr R Jino	Associate Professor	VISTAS
3	Dr. P. R. Kalyana Chakravarthy	Assistant Professor	Vels University
4	Mrs S Durgalakshmi	Assistant Professor	Vels University

External Expert Members

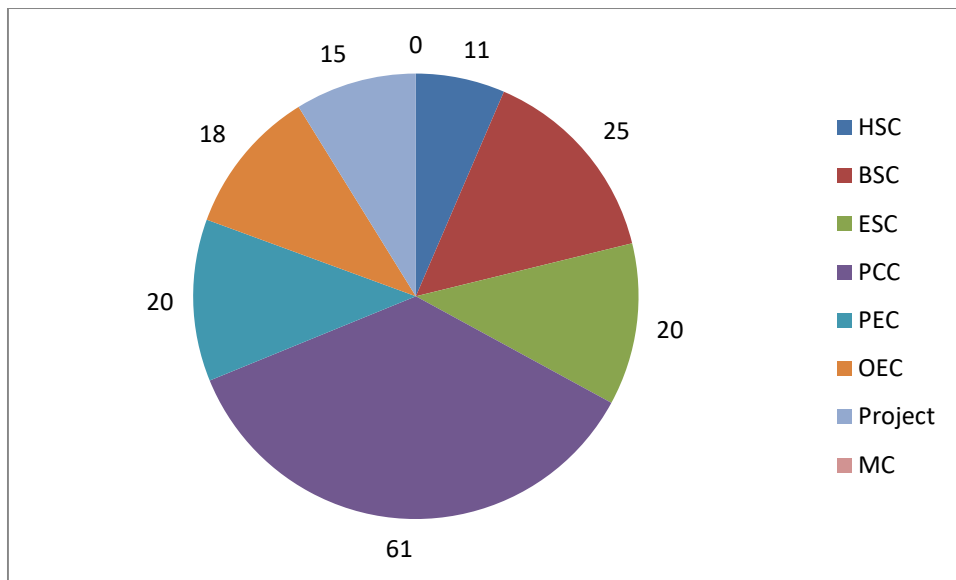
5	Dr. P Purusothaman	Associate Professor	SRM Institute of Science & Technology, Chennai
6	Mr K Gurusamy	Project Manager	Rapid Rail Transit System, L&T Metro, Chennai

Alumni

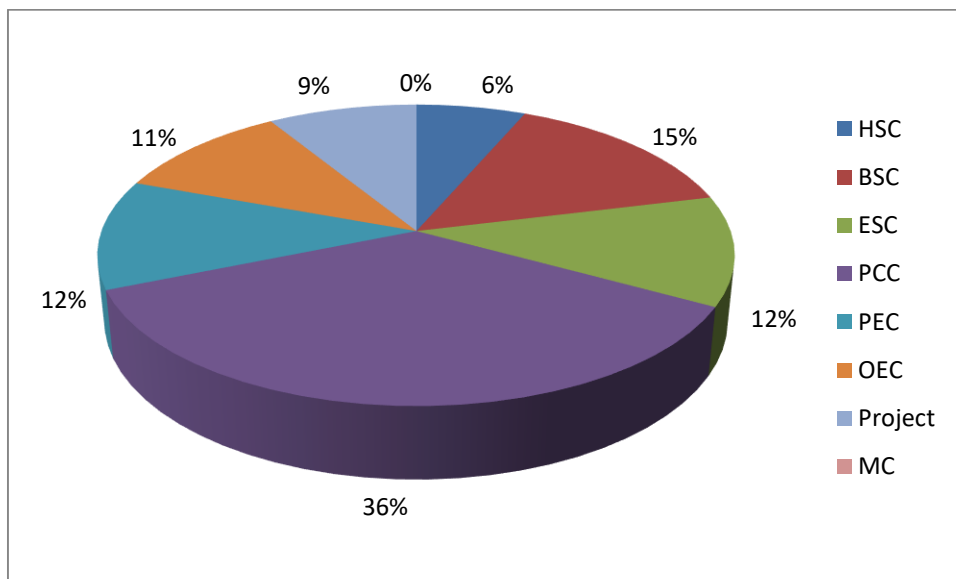
7	Mr. J Pradeep	Site Engineer	Vishala Glazers Pvt Ltd, Chennai
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B.E (Civil Engineering)										
Credits Per Semester										
S. No	Course Category	1	2	3	4	5	6	7	8	Total Credits
1	HSC	3	0	2	2	2	2	0	0	11
2	BSC	8	8	4	5	0	0	0	0	25
3	ESC	7	10	3	0	0	0	0	0	20
4	PCC	0	0	14	17	16	10	4	0	61
5	PEC	0	0	0	0	3	7	7	3	20
6	OEC	0	0	0	0	3	3	6	6	18
7	Project	0	0	0	0	0	0	5	10	15
8	MC	0	0	0	0	0	0	0	0	0
Total		18	18	23	24	24	22	22	19	170
HSC					Humanities and Social Science Courses					
BSC					Basic Science Courses					
ESC					Engineering Science Courses					
PCC					Professional Core Courses					
PEC					Professional Elective Courses					
OEC					Open Elective Courses					
EEC					Employability Enhancement Courses					
MC					Mandatory Courses					

CREDIT DISTRIBUTION



CREDIT PERCENTAGE DISTRIBUTION



HSC – Humanities and Social Sciences Courses

BSC – Basic Science Courses

ESC – Engineering Science Courses

PCC – Professional Core Courses

PEC – Professional Elective Courses

OEC – Open Elective Courses

MC – Mandatory Courses

B.E - CIVIL ENGINEERING CURRICULUM

(MINIMUM CREDITS TO BE EARNED: 170)

SEMESTER 1

Category	Course	Hours / Week			Credits	CA	SEE	Total
		Lecture	Tutorial	Practical				
HSC	English	2	-	-	2	40	60	100
BSC	Physics (Mechanics and Mechanics of Solids)	3	-	-	3	40	60	100
BSC	Mathematics I	3	1	-	4	40	60	100
ESC	Basic Electrical and Electronics Engineering	3	-	-	3	40	60	100
ESC	Engineering Graphics and Design	1	-	4	3	40	60	100
HSC	English Laboratory	-	-	2	1	40	60	100
BSC	Physics Laboratory	-	-	2	1	40	60	100
ESC	Basic Electrical and Electronics Engineering Laboratory	-	-	2	1	40	60	100
MC	Constitution of India	2	-	-	-			100
MC	Student Induction Program	-	-	-	-	-	-	-
		14	1	10	18			

SEMESTER 2

Category	Course	Hours / Week			Credits	CA	SEE	Total
		Lecture	Tutorial	Practical				
BSC	Chemistry	3	-	-	3	40	60	100
BSC	Mathematics II	3	1	-	4	40	60	100
ESC	Programming for Problem Solving	3	-	-	3	40	60	100
ESC	Basics of Civil and Mechanical Engineering	3	-	-	3	40	60	100
ESC	Workshop and Manufacturing Practices	1	-	4	3	40	60	100
BSC	Chemistry Laboratory	-	-	2	1	40	60	100
ESC	Programming for Problem Solving Laboratory	-	-	2	1	40	60	100
MC	Universal Human Values	2	-	-	-			100
		15	1	8	18			

SEMESTER 3

Category	Course	Hours / Week			Credits	CA	SEE	Total
		Lecture	Tutorial	Practical				
BSC	Mathematics III	3	1	-	4	40	60	100
ESC	Energy Science & Engineering	3	-	-	3	40	60	100
PCC	Introduction to Fluid Mechanics	3	1	-	4	40	60	100
PCC	Introduction to Solid Mechanics	3	1	-	4	40	60	100
PCC	Engineering Mechanics	3	-	2	4	40	60	100
PCC	Strength of Materials Laboratory	-	-	2	1	40	60	100
PCC	Hydraulics Laboratory	-	-	2	1	40	60	100
HSC	Personality Development I	2	-	-	2	40	60	100
MC	Basic Life Skills	2	-	-	-			100
		19	3	6	23			

SEMESTER 4

Category	Course	Hours / Week			Credits	CA	SEE	Total
		Lecture	Tutorial	Practical				
BSC	Biology for Engineers	2	-	-	2	40	60	100
PCC	Surveying & Geomatics	3	-	-	3	40	60	100
PCC	Mechanics of Materials	3	-	-	3	40	60	100
PCC	Disaster Preparedness & Planning	2	-	-	2	40	60	100
PCC	Transportation Engineering	3	-	-	3	40	60	100
PCC	Engineering Geology	3	-	2	4	40	60	100
PCC	Computer Aided Civil Engineering Drawing Laboratory	-	-	2	1	40	60	100
PCC	Modern Surveying Laboratory	-	-	2	1	40	60	100
HSC	Personality Development II	2	-	-	2	40	60	100
BSC	Environmental Science and Engineering	3	-	-	3	40	60	100
MC	Gender Institution and Society	2	-	-	-			100
		23	-	6	24			

SEMESTER 5

Category	Course	Hours / Week			Credits	CA	SEE	Total
		Lecture	Tutorial	Practical				
PCC	Geotechnical Engineering	3	1	-	4	40	60	100
PCC	Structural Analysis	3	1	-	4	40	60	100
PEC	Professional Elective Course - I	3	-	-	3	40	60	100
OEC	Open Elective Course - I	3	-	-	3	40	60	100
PCC	Construction Engineering and Management	3	-	2	4	40	60	100
PCC	Geotechnical Engineering Laboratory	-	-	2	1	40	60	100
PCC	Environmental Engineering Laboratory	-	-	2	1	40	60	100
HSC	Personality Development III	2	-	-	2	40	60	100
PCC	Industrial Training/ Mini Project/ Survey Camp/ MOOC Course (NPTEL/SWAYAM/Course Era/Mathworks) - Minimum 4 weeks	-	-	4	2			100
		17	2	10	24			

SEMESTER 6

Category	Course	Hours / Week			Credits	CA	SEE	Total
		Lecture	Tutorial	Practical				
PCC	Design of Reinforced Concrete Structures	3	-	-	3	40	60	100
PCC	Concrete Technology	3	-	-	3	40	60	100
PEC	Professional Elective Course - II	3	-	-	3	40	60	100
PEC	Professional Elective Course - III	3	-	2	4			
OEC	Open Elective Course - II	3	-	-	3	40	60	100
PCC	Computer Aided Design and Drawing Laboratory	-	-	2	1	40	60	100
PCC	Concrete Technology Laboratory	-	-	2	1	40	60	100
HSC	Personality Development - IV	2	-	-	2	40	60	100
PCC	Summer Internship (4 weeks)	-	-	4	2			100
		17	0	10	22			

SEMESTER 7

Category	Course	Hours / Week			Credits	CA	SEE	Total
		Lecture	Tutorial	Practical				
PCC	Engineering Economics, Estimation and Costing	3	-	-	3	40	60	100
OEC	Open Elective Course – III	3	-	-	3	40	60	100
OEC	Open Elective Course – IV	3	-	-	3	40	60	100
PEC	Professional Elective Course - IV	3	-	-	3	40	60	100
PEC	Professional Elective Course - V	3	-	2	4	40	60	100
PCC	Estimation and Costing Laboratory	-	-	2	1	40	60	100
Project	Project Phase I	-	-	10	5	40	60	100
		15	0	14	22			

SEMESTER 8

Category	Course	Hours / Week			Credits	CA	SEE	Total
		Lecture	Tutorial	Practical				
PEC	Professional Elective Course - VI	3	-	-	3	40	60	100
OEC	Open Elective Course - V	3	-	-	3	40	60	100
OEC	Open Elective Course – VI	3	-	-	3	40	60	100
Project	Project Phase II	-	-	20	10	40	60	100
		9	0	20	19			

LIST OF PROFESSIONAL ELECTIVE COURSES

22ECV101	Design of Pre-stressed Concrete Structures
22ECV102	Special Concretes
22ECV103	Earthquake Engineering
22ECV104	Metal Structure Behaviour
22ECV105	Soil Mechanics I
22ECV106	Soil Mechanics II
22ECV107	Foundation Engineering
22ECV108	Ground Improvement Techniques
22ECV109	Environmental Geotechnology
22ECV110	Environmental Engineering
22ECV111	Air & Noise Pollution Control
22ECV112	Solid & Hazardous Waste Management
22ECV113	Physio-Chemical Processes for Water & Waste Water Treatment
22ECV114	Ecological Engineering
22ECV115	Irrigation Engineering

LIST OF BLENDED PROFESSIONAL ELECTIVE COURSES

22ECV201	Design of Steel Structures
22ECV202	Traffic Engineering and Management

LIST OF OPEN ELECTIVE COURSES (MANAGEMENT)

22ECV151	Organizational Behaviour
22ECV152	Total Quality Management
22ECV153	E- Commerce

LIST OF OPEN ELECTIVE COURSES (TECHNICAL)

22ECV154	Global Warming and Climate Change
22ECV155	Public Transportation System
22ECV156	Principles of Architecture
22ECV157	Air pollution Management
22ECV158	Intellectual Property Rights
22ECV159	Principles of Management and Professional Ethics
22ECV160	Role of Citizens in Environment Conservation

LIST OF EMPLOYABILITY ENHANCEMENT COURSES

22CPD201	Personality Development – I
22CPD202	Personality Development – II
22CPD203	Personality Development – III
22CPD204	Personality Development – IV

SYLLABUS
CORE COURSES

COURSE OBJECTIVES

COURSE OBJECTIVES

- To acquire ability to speak effectively in real life situations.
- To write letters and reports effectively in formal and business situations.
- To develop listening skills for academic and professional purposes.
- To gain effective speaking and listening skills in communication.
- To develop the soft skills and interpersonal skills to excel in their career.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment procedures.

UNIT I VOCABULARY BUILDING 8

General Vocabulary –Nouns--Compound nouns, Synonyms, Antonyms, Prefixes and Suffixes, Homonyms, Homographs and Homophones, Changing words from one form to another, Acronyms and Abbreviations.-
Instructions.

UNIT II BASIC WRITING 8

Sentences structures –Kinds of sentences, Types of sentences, Clauses and Phrases, Punctuations, Blending and Clipping, Framing questions- Yes/No types and “Wh” questions, Summarizing, Precise writing, Paragraph Writing.

UNIT III IDENTIFYING COMMON ERRORS IN ENGLISH 8

Articles, Prepositions, Subject-verb Agreement, Pronouns - Relative pronouns, Demonstrative pronouns, Misplaced Modifiers, Redundancies, Clichés, Infinitives& Gerund , Checklist.

UNIT IV NATURE AND STYLE OF SENSIBLE WRITING 8

Situational Dialogues, Process description, Definitions, Numerical Expressions, Recommendation, Information Transfer- Flow chart Bar chart and Pie chart, Writing introduction and conclusion.

UNIT V WRITING PRACTICES 8

Active voice and Passive voice, Making negative sentences, Tenses, Letter Writing- Formal & Informal Letters, Report Writing- Letter Report, Accident Report, Investigation Report and Survey, Essay writing, Reading Comprehension Passages.

TOTAL - 40 HOURS

TEXT BOOKS:

T1: Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.

- T2: Department of Humanities and Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
- T3: Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
- T4: Department of Humanities and Social Sciences, Anna University, "English for Engineers and Technologists" Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
- T5: M. Ashraf Rizvi, "Effective Technical Communication", Tata McGraw-Hill Publishing Company Limited, New Delhi.2009.

REFERENCE BOOKS:

- R1: Practical English Usage. Michael Swan. OUP. 1995.
- R2: Remedial English Grammar. F.T. Wood. Macmillan.2007
- R3: On Writing Well. William Zinsser. Harper Resource Book. 2001
- R4: Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- R5: Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- R6: Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

WEBLINKS:

1. <https://ehlion.com/magazine/technical-english/>
2. https://www.kkcl.org.uk/pdf/KKCL_Technical_English_for_Engineers_Brochure.pdf

COURSE OUTCOMES

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills

C01:	Improve the language proficiency of a technical under-graduate in English with emphasis on Learn, Speak, Read and Write skills	K2
C02:	Develop listening skills for academic and professional purposes	K3
C03:	Acquire the ability to speak effectively in English in real life situations	K3
C04:	Provide learning environment to practice listening, speaking, reading and writing skills	K3
C05:	Variety of self-instructional modes of language learning and develop learner autonomy	K3

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	-	-	-	-	2	2	-	2	3	3	3	3	-	2
CO 2	-	-	-	-	2	2	-	2	3	3	3	3	--	2
CO 3	-	-	-	-	-	-	2	-	1	1	1	1	-	2
CO 4	-	-	-	-	2	1	3	1	-	-	-	-	-	2
CO 5	-	1	2	2	2	2	-	2	3	3	3	3	-	2
Average	-	1.0	2.0	2.0	2.0	1.8	2.5	1.8	2.5	2.5	2.5	2.5	-	2

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation
			✓	✓

22CGE102	MECHANICS AND MECHANICS OF SOLIDS	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- To learn the basic ideas of vector mechanics of particles, kinematics and their planar rigid bodies.
- To apply these fundamental principles to mechanics of solids related to materials used in engineering applications.

UNIT I VECTOR MECHANICS OF PARTICLES 9

Scalar and vector quantities - Different types of vectors - Work-energy theorem - Newton's laws of motion - Collisions - Elastic and inelastic collisions in one dimension - Conservative and non-conservative Forces - Expression for Five-term acceleration equation - Conservation of angular momentum - Definitions of damped oscillations, forced oscillations and resonance - Linear Harmonic oscillator - Expression for time period.

UNIT II KINEMATICS 9

Definition and motion of a rigid body in the plane -Parallelogram law of vectors - Lami's theorem - Experimental proof - Work done by a constant force - Angular displacement - Angular velocity - Angular acceleration - Relation between linear and angular velocities - Uniform circular motion - Law of conservation of linear momentum and its applications.

UNIT III PLANAR RIGID BODY MECHANICS 9

Rotational motion of rigid bodies – Comparison of linear and rotational motions - Equations of rotational motion - Rotational kinetic energy and moment of inertia of a rigid body - Theorems of moment of inertia: Parallel axes theorem and Perpendicular axes theorem - Moment of force - Angular momentum of a rigid body - Relation between torque and angular momentum

UNIT IV STATICS 9

Factor of safety - Different types of supports – Free body diagrams with examples on modelling of typical supports and joints – Types of equilibrium - Centre of mass of two particle systems – Principle of moments - Experimental determination of mass of the given body using principle of moments.

UNIT V MECHANICS OF SOLIDS 9

Concepts of elasticity - Stress-strain diagram - Hooke's law - Experimental verification of Hooke's law - Poisson's ratio - Modulus of elasticity - Factors affecting elasticity - Bending moment - Cantilever – Expression for depression -Young's modulus by uniform bending - I-shaped girders.

TOTAL: 45 hours

TEXT BOOKS:

- T1: D. S. Mathur– Mechanics, II Edition, S. Chand and Co, 2001.
- T2: Narayanamoorthy - Mechanics Part I and II, National Publishing Company, 2010.
- T3: R. Murugesan - Mechanics and Mathematical Methods, 1st Edition, S. Chand and Co, 1996.
- T4: Dr. P. Mani, 'A text book of Engineering Physics – II' Shri Dhanam Publilsher, 2016.

REFERENCE BOOKS:

- R1: M.K. Harbola, Engineering Mechanics, Cengage learning India Publisher, 2009.
- R2: M.K. Verma, Introduction to Mechanics, CRC press, 2009.
- R3: D. Kleppner, R. Kolenkow, An Introduction to Mechanics, Tata McGraw Hill Education, 2007.
- R4: E.P. Popov, Engineering Mechanics of Solids, Pearson publisher, 2015.

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc22_ce46/preview
2. https://onlinecourses.nptel.ac.in/noc21_me70/preview
3. https://onlinecourses.nptel.ac.in/noc20_me01/preview
4. https://www.vssut.ac.in/lecture_notes/lecture1423904717.pdf

COURSE OUTCOMES

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

C01:	Demonstrate the basic ideas of five-term acceleration equation	K3
C02:	Illustrate the fundamental concepts of kinematics	K2
C03:	Identify the stress-strain curve of the solid materials	K2
C04:	Illustrate the rotational equations of motion	K3
C05:	Analyze the free body diagram and their applications	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	2	3	2	-	-	-	-	-	-	-	3	2
CO 2	2	1	1	2	2	-	2	-	-	-	-	-	1	-
CO 3	1	2	1	3	2	2	2	-	-	-	-	-	3	1
CO 4	2	1	1	2	2	-	-	-	-	-	-	-	1	1
CO 5	2	2	2	3	2	2	-	-	-	-	-	-	3	3
Average	1.8	1.6	1.4	2.6	2	2	2	-	-	-	-	-	2.2	1.8

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✓	✓

REFERENCE BOOKS:

- R1: Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
 R2: Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
 R3: D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

WEBLINKS:

1. <https://www.sanfoundry.com/differential-integral-calculus-problems>
2. <https://www.geeksforgeeks.org/rolles-and-lagranges-mean-value-theorem/>
3. <https://home.iitk.ac.in/~aralal/MTH102/la.pdf>

COURSE OUTCOMES

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

C01:	Apply the concept of differential calculus and to evaluate the curvature, radius of curvature and envelope.	K3
C02:	Evaluate the concept of limits, continuity and to evaluate derivatives.	K5
C03:	Analyze the convergence of the series using root test, D'Alembert's test, Leibnitz's test	K5
C04:	Determine the concept of limits, continuity and to evaluate derivatives with functions of several variables that is essential in most branches of engineering.	K5
C05:	Evaluate the linear independence and dependence of vectors, linear transformations and inner product space.	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
C01	2	3	3	3	2	-	-	-	-	-	-	-	2	2
C02	2	2	-	3	3	-	-	-	-	-	-	-	3	-
C03	3	3	3	2	-	-	-	-	-	-	-	-	2	2
C04	3	2	-	-	3	-	-	-	-	-	-	-	2	-
C05	1	3	3	2	2	-	-	-	-	-	-	-	2	2
Average	2.2	2.6	3	2.5	2.5	-	-	-	-	-	-	-	2.2	2.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open book test
			✓		

COURSE OBJECTIVES

- To obtain basic knowledge on electrical quantities such as current, voltage, power and energy.
- To provide employability skill of adequate working knowledge on basic DC and AC circuits used in electrical and electronic devices. To understand the working principle, construction, applications of DC machines, AC machines & measuring instruments.

UNIT I DC CIRCUITS**12**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, Mesh and Nodal analysis, Analysis of simple circuits with dc excitation, Wye↔Delta Transformation, Superposition, Thevenin and Norton Theorems.

UNIT II AC CIRCUITS**12**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III TRANSFORMERS**12**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT IV ELECTRICAL MACHINES & POWER CONVERTERS**12**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Construction of Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. DC-DC buck and boost converters, duty ratio control. Single phase Bridge Rectifier, Single Phase voltage source inverters.

UNIT V BASICS OF ELECTRONICS**12**

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics. Binary Number System — Boolean Algebra theorems– Logic gates- Introduction to sequential Circuits– Flip-Flops.

TEXT BOOKS:

- T1: D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
 T2: D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
 T3: John Bird, "Electrical Circuit theory and technology", Routledge; 5th edition, 2013

REFERENCE BOOKS:

- R1: L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
 R2: E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
 R3: V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989 Text book 1

WEB LINKS:

1. <https://www.electricaltechnology.org/category/basic-electrical-fundamentals>
2. <https://www.electrical4u.com/electrical-engineering-articles/basic-electrical/>

COURSE OUTCOMES

C01:	Understand and analyse DC circuits	K2
C02:	Understand and analyse AC circuits	K2
C03:	Explain the construction, operation and characteristics of transformer and classify the types of three –phase transformer connections.	K3
C04:	Understand and examine the various electrical machines and converter circuits	K2
C05:	Identify the basics of electronics	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	2	3	1	1	1	2	1	-	-	1	-	1	1	-
C02	3	3	1	1	2	-	-	-	-	1	-	2	1	-
C03	2	1	2	2	1	3	3	2	-	2	1	1	2	1
C04	2	-	1	1	1	3	2	1	-	2	2	1	2	1
C05	2	1	1	1	1	2	-	-	-	1	-	1	-	-
Average	2.2	2.0	1.2	1.2	1.2	2.5	2.0	1.5	-	1.4	1.5	1.2	1.5	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
√	√	√	√	√	
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
√	√			√	√

COURSE OBJECTIVES

- To familiarize the students in basic concept of conic sections, projections and developments of objects.
- To develop the imagination and drafting skills of students and pictorial projections.

UNIT I DIMENSIONING AND GEOMETRICAL CONSTRUCTION**12**

BIS - Lettering - Two systems of dimensioning, Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, Epicycloid, Hypocycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES**12**

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

UNIT III PROJECTION OF SOLIDS**12**

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

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES**12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones

UNIT V ORTHOGRAPHIC PROJECTION AND ISOMETRIC PROJECTION**12**

General principles of orthographic projection – Need for importance of multiple views and their placement - layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects. Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

TOTAL: 60 hours**TEXT BOOKS:**

- T1: Bhatt N.D. and Panchal V.M., –Engineering Drawing, Charotar Publishing House, 50th Edition, 2010.

T2: Parthasarathy N.S. and Vela Murali, —Engineering Drawing, Oxford University Press, New Delhi, 1st Edition, 2015

REFERENCE BOOKS:

R1: Natarajan K.V., —A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 31st Edition, 2018.

R2: Basant Agrawal and Agrawal C.M., —Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2nd Edition, 2013.

WEB LINKS:

1. <https://nptel.ac.in/courses/112103019>
2. <https://alison.com/course/diploma-in-engineering-drawing-and-computer-graphics>

COURSE OUTCOMES

C01:	Sketch the drawing standards, conventions and practices in engineering drawing	K1
C02:	Draw the orthographic projections of points, straight lines and plane surfaces for solving some of the engineering problems in day-to-day applications.	K1
C03:	Sketch the orthographic projections for the points, straight lines or solids using the change of position method.	K1
C04:	Draw projections of sectioned solids and development of lateral surfaces and apply the concept to simple sheet metal work.	K6
C05:	Draw the isometric projections for the given solids and combination of solids using box method and create 3D models	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	1	2	-	2	-	-	-	-	3	-	2	2	1
C02	2	3	2	-	2	-	-	-	-	3	-	3	2	3
C03	2	2	2	-	2	-	-	-	-	3	-	2	2	2
C04	2	2	2	-	2	-	-	-	-	3	-	2	2	2
C05	2	2	2	-	2	-	-	-	-	3	-	3	2	2
Average	2.0	2.0	2.0	-	2.0	-	-	-	-	3.0	-	2.4	2.0	2.0

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Viva
✓	✓	✓	✓	✓	✓
Record	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓		✓		✓	

COURSE OBJECTIVES

- To enable the student to explore knowledge in communication skills
- To gain knowledge in the process of Placement Interviews, Group Discussions and other recruitment procedures

List of Experiments

1. Introduction to English sounds
2. Consonants and vowels
3. Syllable and Stress
4. Intonation
5. Communication Skills
6. Summarizing
7. Report Writing
8. Information Transfer
9. Presentation Skills
10. Group Discussion
11. Letter Writing
12. Cover letter and Resume

Total- 30 Hours**TEXT BOOKS:**

- T1: Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
- T2: M. Ashraf Rizvi, "Effective Technical Communication", Tata McGraw-Hill Publishing Company Limited, New Delhi.2009.

REFERENCE BOOKS:

- R1: Practical English Usage. Michael Swan. OUP. 1995.
- R2: Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- R3: Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

WEBLINKS:

1. <https://onlinemasters.ohio.edu/blog/engineering-communication/>
2. <https://online.rice.edu/courses/communication-skills-for-engineers-specialization>

COURSE OUTCOME

C01:	Distinguish various listening & written contexts for understanding the implied meanings and responding to them accordingly.	K5
C02:	Use appropriate pronunciation and rhythm of spoken language in oral communication	K4
C03:	Draft and interpret the written communication in official contexts like narrative, descriptive, creative, critical and analytical reports	K5
C04:	Infer implied meanings of different genres of texts and critically analyze and evaluate them for ideas, as well as for method of oral presentation.	K4
C05:	Make use of suitable communicative strategies to express their point of views convincingly in any type of discussions, negotiation and conversations.	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PS01	PS02
C01	2	1	-	-	2	-	2	-	-	-	-	-	-	2
C02	3	2	1	1	3	1	3	3	-	-	-	-	-	3
C03	3	2	1	1	3	1	3	3	-	-	-	-	-	3
C04	3	2	1	1	3	1	3	3	-	-	-	-	-	3
C05	3	2	1	1	3	1	3	3	-	-	-	-	-	3
Average	2.8	1.8	1.0	1.0	2.8	1.0	2.8	3.0	-	-	-	-	-	2.8

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration/ Presentation
✓		✓		✓

COURSE OBJECTIVES

- To enable the student to explore the field of Mechanics of Solids and Properties of Matter.
- To gain knowledge in the scientific methods and learn the process of measuring different Physical variables.

Any Eight Experiments

1. Determination of Rigidity Modulus – Torsional pendulum
2. Determination of wavelength and particle size using laser
3. Ultrasonic Interferometer
4. Determination of band gap of a semiconductor material
5. Hooke's law – Determination of spring constant
6. Determination of Young's Modulus – Uniform Bending
7. Determination of Young's Modulus – Non Uniform Bending
8. Determination of Viscosity of a liquid - Poiseuille's method
9. Spectrometer – Grating
10. Deflection Magnetometer - Tan A position
11. Deflection Magnetometer - Tan B position
12. Potentiometer - Calibration of low range Voltmeter

TEXT BOOKS:

- T1: C. C. Ouseph, U. J. Rao, V. Vjiayendran, Practical Physics, 1st Edition, 2015.
- T2: Biswajit Saha, Practical Physics Book, LAP LAMBERT Academic Publishing, 1st Edition, 2020.

REFERENCE BOOKS:

- R1: G.L. Squires, Practical Physics, 4th Edition, Cambridge University Press, 2001.
- R2: D. Chattopadhyay, P.C. Rakshit, B. Saha, "An Advanced Course in Practical Physics", 2nd ed., Books & Allied Ltd., Calcutta, 1990.

WEB LINKS:

1. <http://amrita.olabs.edu.in/?sub=1&brch=5&sim=155&cnt=2>
2. <https://vlab.amrita.edu/index.php?sub=1&brch=280&sim=1509&cnt=4>

COURSE OUTCOMES

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

C01:	Measure the wavelength and particle size of semiconductor diodelaser.	K3
C02:	Analyze the coefficient of viscosity of a liquid	K4
C03:	Estimate the band gap energy of given semiconductor material.	K5
C04:	Determine the compressibility of the liquid using ultrasonic interferometer	K4
C05:	Measure the Young's modulus of the given solid materials	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C01	-	1	1	3	2	3	1	-	1	-	-	-	3	2
C02	-	1	1	2	2	-	1	-	-	-	-	-	1	-
C03	-	1	1	3	2	3	3	-	1	-	-	-	3	2
C04	-	1	1	3	2	2	-	-	-	-	-	-	1	-
C05	-	1	1	3	2	2	1	-	1	-	-	-	3	2
Averag e	-	1.0	1.0	2.8	2.0	2.5	1.5	-	1.0	-	-	-	2.2	2.0

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓			✓	✓

22CGE108	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	Credits
	LABORATORY	0	0	2	1

COURSE OBJECTIVES

- To provide comprehensive idea about AC and D C circuit analysis, working principles and applications of basic machines in electrical engineering.
- To expose the students to learn experimental skills about Transformers, DC Motor, Converters.

LIST OF EXPERIMENTS

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
3. Loading of a transformer: measurement of primary and secondary voltages and currents, and power
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line- line voltage, phase-to-neutral voltage, line and phase currents).
5. Load Characteristics of a DC Motor
6. Torque - Slip Characteristic of an Induction motor
7. Three phase induction motors – Direction reversal by change of phase-sequence of connections.
8. Demonstration of DC-DC Converter.
9. Demonstration of DC-AC converter.
10. Demonstration of AC-DC converter.

TOTAL: 30 Hours

COURSE OUTCOMES

CO1:	Understand the basic safety precautions and learn to make use of measuring instruments	K2
CO2:	Analyze the steady state response of R-L, R-C circuits	K3
CO3:	Experiment with loading of transformer to measure the primary and secondary voltages, currents and power and classify the different types of transformer connections	K3
CO4:	Understand and Experiment with single phase induction motor and three phase induction motor	K2
CO5:	Demonstrate DC-DC, DC-AC and AC-DC converters	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
C01	3	2	2	2	2	-	-	-	-	-	-	-	2	2
C02	3	2	2	3	2	-	-	-	-	-	-	-	3	3
C03	3	3	2	3	3	-	-	-	-	-	-	-	3	3
C04	3	3	3	3	3	-	-	-	-	-	-	-	3	3
C05	3	3	3	3	3	-	-	-	-	-	-	-	3	3
Average	3.0	2.6	2.4	2.8	2.6	-	-	-	-	-	-	-	2.8	2.8

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
		√			
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
				√	

22MCMC11	CONSTITUTION OF INDIA	L	T	P	Credits
		2	0	0	0

COURSE OBJECTIVES:

- The purpose of the course is to acquaint the students with basic principles of the Constitution of India and its working.
- To help students be familiar with the historical and significant aspects of the constitution of India.
- To make students aware of their fundamental duties and rights.
- To know about central and state government functionalities in India.

UNIT I NATURE, OBJECT AND SCOPE OF THE CONSTITUTION 6

Nature, object and scope of Constitutional Law and Constitutionalism – Historical Perspective of the Constitution of India – Salient Features and Characteristics of Constitution of India.

UNIT II FUNDAMENTAL RIGHTS 6

Nature and scope of Fundamental Rights – Scheme of Fundamental Rights – Right to Equality – Right to Freedom of Speech and Expression – Right to Life – Right against Exploitation – Right to Religious Freedom – Minority Rights.

UNIT III DIRECTIVE PRINCIPLES OF STATE POLICY AND FUNDAMENTAL DUTIES 6

Directive Principles of State Policy – Importance and Implementation – Scheme of Fundamental Duties and its Legal Status.

UNIT IV FEDERAL STRUCTURE 6

Federal Structure – Distribution of Legislative and Financial Powers between the Union and the States – Parliamentary Form of Government in India – Constituent Powers and Status of the President of India.

UNIT V AMENDMENT AND EMERGENCY PROVISIONS 6

Amendment of the Constitution – Procedure – Historical Perspective of the Constitutional Amendments in India – Emergency Provisions – National Emergency – President Rule – Financial Emergency – Local Self Government – Constitutional Scheme in India.

TOTAL: 30 Hours

TEXT BOOKS:

- T1: V.N. Shukla, Constitutional Law of India
T2: D.D. Basu, Commentary on the Constitution of India
T3: J.N. Pandey, Constitution of India
T4: Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
T5: R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.

T6: Maciver and Page, "Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
 T7: K.L.Sharma, (1997) "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi.

REFERENCES BOOKS:

- R1: V.D. Mahajan, Constitutional Law of India
 R2: H.M. Seervai, Constitution of India
 R3: Sharma, Brij Kishore, "Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
 R4: U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
 R5: R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

COURSE OUTCOMES

C01:	Elaborate the constitution of India and its salient features.	K2
C02:	Infer the fundamental rights and duties.	K2
C03:	Discuss the Parliamentary Form of Government in India.	K2
C04:	Recognize the Directive Principles of State Policy.	K3
C05:	Understand and abide by the rules of the Indian constitution and to appreciate different culture among the people.	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	-	-	-	-	-	3	-	2	-	-	-	3	1	-
C02	-	-	-	-	-	3	2	2	-	-	-	3	1	-
C03	-	-	-	-	-	3	2	2	1	-	-	3	1	-
C04	-	-	-	-	-	3	2	2	1	-	-	3	1	-
C05	-	-	-	-	-	3	3	2	1	-	-	3	1	-
Average	-	-	-	-	-	3.0	2.3	2.0	1.0	-	-	3.0	1.0	-

ASSESSMENT METHODS:

CAT1	CAT2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
			✓		

22CGE201	ENGINEERING CHEMISTRY	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- To learn about the molecular orbitals, ionic interactions and periodic properties.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electro negativity.
- List major chemical reactions that are used in the synthesis of molecules.

UNIT I ATOMIC AND MOLECULAR STRUCTURE, INTERMOLECULAR FORCES 9 **AND POTENTIAL ENERGY SURFACES**

Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene, benzene and aromaticity. Valence Bond Theory and the energy level diagrams for transition metal ions and their magnetic properties. Ionic, dipolar and van Der Waals interactions, potential energy surfaces of H₃, H₂F and HCN.

UNIT II SPECTROSCOPIC TECHNIQUES AND APPLICATIONS 9

Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational, rotational spectroscopy of diatomic molecules, Morse equations and Mossbauer spectroscopy. Applications. Diffraction and scattering

UNIT III USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA 9

Thermodynamic functions: energy, entropy, free energy and fugacity. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

UNIT IV PERIODIC PROPERTIES 9

Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, diagonal relationship, anomalous behaviour of Lithium, carbon and Nitrogen, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

UNIT V ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE 9

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization, Coupling reaction and ring openings. Synthesis of a commonly used drug molecule.

TOTAL: 45 hours

TEXT BOOKS

- T1: Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
T2: Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
T3: Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.

REFERENCE BOOKS

- R1: Physical Chemistry, by P. W. Atkins.
R2: Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.
R3: University chemistry, by B. H. Mahan.

WEB LINKS:

1. <https://opentextbc.ca/chemistry/chapter/10-1-intermolecular-forces/>
2. <https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod2.pdf>
3. [https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_\(Physical_and_Theoretical_Chemistry\)/Thermodynamics/Chemical_Energetics/Free_Energy_and_Equilibrium](https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Thermodynamics/Chemical_Energetics/Free_Energy_and_Equilibrium)
4. [https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_\(Inorganic_Chemistry\)/Descriptive_Chemistry/Periodic_Trends_of_Elemental_Properties/Periodic_Properties_of_the_Elements](https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_(Inorganic_Chemistry)/Descriptive_Chemistry/Periodic_Trends_of_Elemental_Properties/Periodic_Properties_of_the_Elements)
5. <https://www.bcebhagalpur.ac.in/wp-content/uploads/2020/03/Organic-Reactions-Synthesis-of-Drug-Molecule.pdf>

COURSE OUTCOMES

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

C01:	Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces	K4
C02:	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	K3
C03:	Analyze bulk properties and processes using thermodynamic considerations	K4
C04:	Classify the properties and reactivity of different types of elements based on the periodic table.	K2
C05:	Apply the basic terms involved in an Organic reactions and synthesis of a drug molecule.	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	P O 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C01	2	1	1	2	1	-	1	-	1	1	-	1	2	-
C02	-	2	1	1	1	-	-	-	1	-	-	-	-	-
C03	-	1	1	1	-	-	-	-	-	1	-	-	-	-
C04	-	1	1	1	-	-	-	-	-	-	-	-	-	1
C05	-	1	-	1	-	-	1	-	-	-	-	-	-	-
Average	2.0	1.2	1.0	1.2	1.0	-	1.0	-	1.0	1.0	-	1.0	2.0	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✓	✓

22CGE202	MATHEMATICS-II (PROBABILITY AND STATISTICS)	L	T	P	Credits
		3	1	0	4

COURSE OBJECTIVES

- To make use of statistical techniques.
- To equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

UNIT I BASIC PROBABILITY 12

Introduction to Probability-Conditional probability – Baye’s Theorem- Random Variables-Discrete random variables-Continuous Random Variables –Probability mass function-Probability density function.

.UNIT II STANDARD DISTRIBUTIONS 12

Introduction to theoretical distribution-Discrete Distributions- Binomial, Poisson, Geometric Distributions- Continuous Distribution-Uniform, Normal, Exponential and Gamma distribution-Properties.

UNIT III CORRELATION AND REGRESSION ANALYSIS 12

Correlation: Types of Correlation-Methods of studying correlation- Scatter diagram method, Karl Pearson’s Coefficient of correlation, Spearman’s Rank Correlation Coefficient. Regression: Regression Lines and Regression equations - simple problems

UNIT IV BASIC STATISTICS 12

Introduction-Measures of Central tendency: Mean, Median and Mode- Measure of Dispersion- Range, Mean deviation- Standard Deviation and coefficient of variation

.

UNIT V SAMPLING 12

Introduction to small sample – t-test-Single mean,difference of means, and Paired t-test- F-test- Chi-square test for goodness of fit and independence of attributes.

TOTAL: 60 hours

TEXT BOOKS:

- T1: N.P. Bali and Manish Goyal, A text book of engineering mathematics, Laxmi publications, reprint, 2014 (Ninth Edition)
- T2: S.P.Gupta, Statistical Methods. Sultan Chand & Sons, New Delhi .
- T3: S.C. Gupta and V.K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand & Sons, 3rd Edition, 2001.

REFERENCE BOOKS:

- R.1. I Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

- R.2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, UniversalBook Stall, 2003 (Reprint).
- R.3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1970
- R.4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

WEB LINKS:

1. <https://nptel.ac.in/courses/111105090>
2. <https://nptel.ac.in/courses/111105041>
3. https://onlinecourses.nptel.ac.in/noc21_ma74/preview

COURSE OUTCOMES

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

C01:	Apply the fundamental concepts of probability	K3
C02:	Make use of standard distributions which can describe real life phenomenon.	K3
C03:	Utilize and critically discuss the issues surrounding of Correlation and Regression	K3
C04:	Evaluate the underlying assumptions of analysis tools of measures of central tendency and dispersion	K5
C05:	Analyze the uses and limitations of Testing of hypothesis used in Engineering	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P 04	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PS01	PS02
C01	2	2	2	3	2	-	-	-	-	-	2	-	-	-
C02	3	-	-	-	-	-	-	-	-	-	-	-	2	-
C03	3	2	2	3	2	-	-	-	-	-	3	-	-	3
C04	3	-	2	-	-	-	-	-	-	-	-	-	2	-
C05	2	3	3	2	2	-	-	-	-	-	3	-	3	3
Average	2.6	2.4	2.3	2.7	2.0	-	-	-	-	-	2.7	-	2.4	3.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignment s
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
				✓

22CGE203	PROGRAMMING FOR PROBLEM SOLVING	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- To understand the basic concepts of programming – Flow chart, Pseudocode
- To learn the fundamentals of C programming - declarations, operators, expressions and control statements.
- To learn the manipulation of strings, functions, pointers and file operations
- To understand the concepts of arrays, basic sorting and searching algorithms.
- To find the order of time complexity of basic algorithms

UNIT I INTRODUCTION TO PROGRAMMING 9

Introduction to Programming (Flow chart/pseudo code, compilation etc.), Variables (including data types) - Arithmetic expressions and precedence, Conditional Branching and Loops -Writing and evaluation of conditionals and consequent branching - Iteration and loops

UNIT II ARRAYS AND BASIC ALGORITHMS 9

Arrays (1-D, 2-D), Character arrays and Strings, Searching, Basic Sorting Algorithms, Finding roots of equations, Notion of order of time complexity through example programs

UNIT III FUNCTIONS AND POINTERS 9

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion with example programs such as Finding Factorial, Fibonacci series, etc. Pointers- Defining pointers, Use of Pointers in self-referential structures.

UNIT IV STRUCTURES AND UNIONS 9

Structures - Defining structures and Array of Structures, Structures containing Pointers, Unions - Storage classes: auto, static, extern, register – Dynamic memory allocation.

UNIT V STRING FUNCTIONS AND FILES 9

Strings - library string functions, pointers in strings, pointers and function arguments, Files - file Operations, processing a file, Preprocessor directives, use of typedef, Command line arguments, Enumerated data types.

TOTAL : 45 hours

TEXT BOOKS:

- T1: Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill
T2: E. Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill

REFERENCE BOOKS:

R.1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", PrenticeHall of India

R.2. Yashavant Kanetkar, "Let Us C", BPB Publications

R.3. Ashok.N.Kamthane, "Computer Programming", Pearson Education

COURSE OUTCOMES

C01:	Construct a pictorial representation with a stepwise procedure for solving complex problems	K3
C02:	Develop a high level programming code using c languages	K3
C03:	Evaluate the various functional operations for solving problem	K5
C04:	Make use of various c operations like array, pointer, strings and searching method	K3
C05:	Develop a C module for a given set of instruction	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
C01	3	2	3	3	3	-	-	-	-	-	-	-	-	2
C02	3	2	2	3	3	-	-	-	-	-	-	-	-	3
C03	3	2	2	3	3	-	-	-	-	-	-	-	-	3
C04	3	2	1	3	3	-	-	-	-	-	-	-	-	3
C05	2	2	3	3	3	-	-	-	-	-	-	-	-	3
Average	2.8	2.0	2.2	3.0	3.0	-	-	-	-	-	-	-	-	2.8

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓	✓		✓	✓	

22CGE204	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES:

- To provide the students an illustration of the significance of the Civil and Mechanical Engineering Profession in satisfying the societal needs.
- To help students acquire knowledge in the basics of surveying and the materials used for Construction.
- To provide an insight to the essentials of components of a building and the infrastructure Facilities.
- To explain the component of power plant units and detailed explanation to IC engines their Working principles.
- To explain the Refrigeration & Air-conditioning system.

UNIT I PART A: OVERVIEW OF CIVIL ENGINEERING 5

Civil Engineering contributions to the welfare of Society - Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering – National building code – terminologists: Plinth area, Carpet area, Floor area, Buildup area, Floor space index - Types of buildings: Residential buildings, Industrial buildings.

UNIT I PART B: OVERVIEW OF MECHANICAL ENGINEERING 4

Overview of Mechanical Engineering - Mechanical Engineering Contributions to the welfare of Society – Specialized sub disciplines in Mechanical Engineering – Manufacturing, Automation, Automobile and Energy Engineering - Interdisciplinary concepts in Mechanical Engineering.

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying: Objects – Classification – Principles – Measurements of Distances and angles – Leveling – Determination of areas– Contours. Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel - Timber – Modern Materials, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials. Modern uses of Gypsum, Pre-fabricated Building component (brief discussion only)

UNIT III BUILDING COMPONENTS AND INFRASTRUCTURE 9

Building plans – Setting out of a Building - Foundations: Types of foundations - Bearing capacity and settlement – Brick masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering. Types of Bridges and Dams – Water Supply Network - Rain Water Harvesting – Solid Waste Management - Introduction to Highways and Railways - Introduction to Green Buildings.

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 9

Classification of Power Plants- Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power

plants- Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines. Working principle of Boilers-Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps, Concept of hybrid engines. Industrial safety practices and protective devices

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM

9

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner. Properties of air - water mixture, concepts of psychometric and its process.

TOTAL: 45 Hours

TEXT BOOKS:

T1: G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018

REFERENCE BOOKS:

- R1: Ramamrutham S., “Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P) Ltd, 2013.
 R2: Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies, 2005.
 R3: Shantha Kumar SRJ., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, 2000.

WEB LINKS:

1. <https://nptel.ac.in/courses/105106201>
2. <https://geekztrainerblog.wordpress.com/basic-civil-and-mechanical-engineering/>

COURSE OUTCOMES:

C01	Understanding profession of Civil and Mechanical engineering.	K2
C02	Summarise the planning of building, infrastructure and working of Machineries.	K2
C03	Apply the knowledge gained in respective discipline	K3
C04	Illustrate the ideas of Civil and Mechanical Engineering applications.	K2
C05	Appraise the material, Structures, machines and energy.	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
C01	-	1	2	2	2	2	-	-	-	-	-	-	2	1
C02	1	2	2	3	3	3	-	-	-	-	-	-	3	2
C03	1	2	2	3	3	3	-	-	-	-	-	-	3	2
C04	1	2	2	3	3	3	-	-	-	-	-	-	2	3
C05	2	3	2	2	3	2	-	-	-	-	-	-	2	3
Average	1.3	2	2	2.6	2.8	2.6	-	-	-	-	-	-	2.4	2.2

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓		✓		✓	

22CGE205	WORKSHOP AND MANUFACTURING PRACTICES	L	T	P	Credits
		1	0	4	3

COURSE OBJECTIVES

- To study bench fitting drawings for making male and female fittings as per the given dimensions and Tolerances.
- To study sheet metal development drawings for making common metal parts/components as per the given dimensions.

DETAILED CONTENTS:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical & Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

WORKSHOP PRACTICE:

1. **MACHINE SHOP** **9**
Machining: Basics of Machining Processes Equipment's, Simple turning of cylindrical surface on MS rod using lathe machine tool, To make Facing and plain turning, step turning, drilling in the lathe
2. **FITTING SHOP** **9**
To make square, V joint in bench fitting as per the given dimension and tolerances, Tools and demonstration of producing model
3. **CARPENTRY** **9**
Basics of Carpentry operations, Equipment's, To make half lap joint, dovetail, TEE Lap joint, Cross halving joint of two wooden pieces at perpendicular direction,
4. **WELDING SHOP** **9**
To make single, butt, lap and T fillet joint by arc welding with the back hand and fore hand welding techniques as per the given dimensions. To make simple Dust pan, Rectangular trays in sheet metal with the jigs as per the given Dimensions.

5. PLUMBING WORKS

9

Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings. Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

TOTAL: 45 hours

TEXT BOOK:

T1: Jeyachandran K., Natarajan S. & Balasubramanian S., A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007

REFERENCE BOOKS:

R1: Jeyapoovan T., Saravanapandian M. & Pranitha S., Engineering Practices Lab Manual, Vikas Publishing House Pvt.Ltd, 2006.

R2: Bawa H.S., Workshop Practice, Tata McGraw, 2007. 4. Rajendra Prasad A. & Sarma P.M.M.S., Workshop Practice, Sree Sai Publication, 2002

COURSE OUTCOMES

C01:	Experiment with facing, Turning and various types of fitting joint	K 1
C02:	Develop the half lap joint, TEE Lap joint carpentry and welding.	K 5
C03:	Practice casting, moulding, & smithy trades	K 2
C04:	Developments of sheet metal jobs from GI sheets, knowledge of basic concepts of soldering	K 5
C05:	Make a Basic pipe connections for Mixed pipe material connection and Pipe connections with different joining components	K 1

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
C01	3	1	3	1	2	-	2	-	2	-	1	2	1	2
C02	3	1	3	1	3	-	2	-	2	-	1	2	2	2
C03	3	1	3	1	2	-	2	-	3	-	1	2	1	1
C04	3	1	2	1	2	-	2	-	2	-	1	2	1	1
C05	3	1	3	1	2	-	2	-	1	-	1	2	2	2
Average	3.0	1.0	2.8	1.0	2.2	-	2.0	-	2.0	-	1.0	2.0	1.4	1.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test

COURSE OBJECTIVES

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- The students will learn to:
 - Estimate rate constants of reactions from concentration of reactants/products as a function of time.
 - Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
 - Synthesize a small drug molecule.

Any Eight Experiments

1. Determination of the rate constant of a reaction.
2. Determination of the partition coefficient of a substance between two immiscible liquids.
3. Determination of surface tension and viscosity.
4. Thin layer chromatography.
5. Determination of chloride content in water.
6. Determination of cell constant and conductance of solutions.
7. Synthesis of a polymer/drug.
8. Determination of saponification / acid value of an oil.
9. Determination of redox potentials and emf by Potentiometric method.
10. Estimate the adsorption of acetic acid by charcoal.

TEXT BOOKS

- T1: S. Sundaram and K. Raghavan "Practical Chemistry", S. Viswanathan. Co. 3rd edition 2011.
- T2: Gnanaprakasam, Ramamurthy, "Organic Chemistry Lab Manual" S. Viswanathan Pvt. Ltd. 3rd edition 2011.

REFERENCE BOOKS

- R1: Vogel's – "Textbook of qualitative organic Analysis", Longmann, 12th edition, 2011
- R2: J. N. Gurtu and R. Kapoor "Advanced experimental Chemistry", S. Chand and Co. 6th edition, 2010.

WEB LINKS

1. <https://www.khanacademy.org/science/ap-chemistry-beta/x2eef969c74e0d802:kinetics/x2eef969c74e0d802:introduction-to-rate-law/v/experimental-determination-of-rate-laws>
2. <https://www.youtube.com/watch?v=qdmKGskCyh8>
3. https://www.youtube.com/watch?v=7_6_dKlo67k

COURSE OUTCOMES

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

C01:	Estimate the rate constants of reactions and partition coefficient of immiscible liquids	K4
C02:	Find the viscosity and to test the purity of the compound	K4
C03:	Estimate the amount of chlorine content present in drinking water and to know the conductance of a solution	K4
C04:	Develop a small drug molecule and to know the saponification of an oil	K6
C05:	Find out the unknown element by Potentiometric method and to remove some of the toxic chemical by charcoal method	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C01	-	1	1	3	1	-	-	-	-	-	-	-	-	-
C02	-	1	1	2	1	-	-	-	-	-	-	-	-	-
C03	-	1	2	3	2	3	3	-	-	-	2	-	2	1
C04	-	1	2	3	3	3	3	-	-	-	2	-	2	1
C05	-	1	1	2	3	2	1	-	-	-	-	-	1	1
Average	-	1.0	1.4	2.6	2.0	2.7	2.4	-	-	-	2.0	-	1.7	1.0

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓			✓	✓

22CGE207	PROGRAMMING FOR PROBLEM SOLVING LABORATORY	L	T	P	Credits
		0	0	2	1

COURSE OBJECTIVE:

- To design and develop C Programs for various applications

LIST OF EXPERIMENTS:

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems
5. 1D Array manipulation
6. Matrix problems
7. String operations
8. Simple functions
9. Solving Numerical methods problems
10. Recursive functions
11. Pointers and structures
12. File operations

Total: 30 Hours

TEXT BOOKS:

- T1: Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill
T2: E. Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill

REFERENCE BOOKS:

- R1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", PrenticeHall of India
R2. Yashavant Kanetkar, "Let Us C", BPB Publications
R3. Ashok.N.Kamthane, "Computer Programming", Pearson Education

COURSE OUTCOMES

C01:	Determine the advanced features of the C language	K5
C02:	Develop the model data using primitive and structured types.	K5
C03:	Construct programs that demonstrate effective use of C features including arrays, structures, pointers and files.	K4
C04:	Develops the ability to analyze a problem, develop an algorithm to solve it.	K5

C05:	Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.	K6
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MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	3	2	2	2	3	-	-	-	-	-	-	2	2	-
C02	2	2	2	2	2	-	-	-	-	-	-	2	2	-
C03	3	2	2	2	2	-	-	-	-	-	-	2	2	-
C04	2	2	3	3	3	-	-	-	-	-	-	2	2	-
C05	2	3	2	3	3	-	-	-	-	-	-	3	2	-
Average	2.4	2.2	2.2	2.4	2.6	-	-	-	-	-	-	2.2	2.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓			✓	✓

22MCMC21	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	L	T	P	Credits
		2	0	0	0

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

UNIT I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION 6

Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration-what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF 6

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health

UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN- HUMAN RELATIONSHIP 6

Understanding harmony in the Family- the basic unit of human interaction, Understanding values in a human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship, Understanding the meaning of *Vishwas*; Difference between intention and competence, Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*) - from family to world family!.

**UNIT IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE –
WHOLE EXISTENCE AS CO-EXISTENCE**

6

Understanding the harmony in Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

**UNIT V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF
HARMONY ON PROFESSIONAL ETHICS**

6

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for the transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Total: 30 Hours

TEXT BOOKS:

T1: R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics Excel Books, New Delhi, 2010

REFERENCE BOOKS:

R1: Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA

R2: E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

R3: Susan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

R4: Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.

COURSE OUTCOMES

CO1:	Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society (K2)	K2
CO2:	Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.	K3
CO3:	Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society	K2
CO4:	Understand the harmony in nature and existence and work out their mutually fulfilling participation in the nature.	K3
CO5:	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	K3

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	-	-	-	-	-	3	3	2	3	1	-	3	2	-
C02	-	-	-	-	-	3	2	2	3	1	-	3	2	-
C03	-	-	-	-	-	3	3	2	3	1	-	3	2	-
C04	-	-	-	-	-	3	2	2	3	1	-	3	2	-
C05	-	-	-	-	-	3	3	3	3	1	-	3	2	-
Average	-	-	-	-	-	3.0	2.6	2.2	3.0	1.0	-	3.0	2.0	-

ASSESSMENT METHODS

CAT1	CAT2	ModelExam	End SemesterExams	Assignments	CaseStudies
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/Presentation	Open booktest
			✓		

22CGE301	MATHEMATICS-III (FOURIER SERIES & TRANSFORMS)	L	T	P	Credits
		3	1	0	4

COURSE OBJECTIVE:

- To learn the concept of Fourier Series and Transforms for various functions in the given interval.
- To Solve the boundary value problems using finite and infinite transforms

UNIT I FOURIER SERIES 12

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

UNIT II FOURIER TRANSFORM 12

Fourier integral theorem (without proof) – Fourier transform pair – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 12

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 functions

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification PDE-Method of separation of variables – One dimensional wave and heat equation – Steady state solution of two-dimensional heat equation (square plate only)

UNIT V	Z -TRANSFORM AND DIFFERENCE Equations	12
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Z-transform -Introduction- properties – Inverse Z-transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

Total: 60 Hours

TEXT BOOKS:

- T1: Grewal. B.S, “Higher Engineering Mathematics”, Khanna Publications, Delhi, 43rd Edition, 2013.
- T2: Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 6th reprint, 2008.
- T3: Sivaramakrishna Das.P & Vijayakumari.C , A Text book of Engineering Mathematics-III

REFERENCE BOOKS:

- R1: Bali.N.P. and Manish Goyal 'A Textbook of Engineering Mathematics', Laxmi Publications, 9th edition, 2011.
- R2: Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition, 2011.

R3: Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, 3rd Edition, 2012.

R4: Transforms and partial differential equations- A.Singaravelu

COURSE OUTCOMES:

C01:	Develop Fourier series for different types of functions	K4
C02:	Determine Fourier Transform	K3
C03:	Derive and obtain the solution of wave, heat equation	K3
C04:	Apply Fourier series and Fourier transforms used in engineering applications	K4
C05:	Understand the z-transforms and its properties	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
C01	2	2	2	2	2	-	-	-	-	-	2	-	-	-
C02	3	2	2	3	3	-	-	-	-	-	-	-	2	-
C03	2	-	2	3	2	-	-	-	-	-	3	-	-	3
C04	3	2	3	3	3	-	-	-	-	-	3	-	3	-
C05	2	2	3	2	2	-	-	-	-	-	3	-	3	3
	2.4	2.0	2.4	2.6	2.4	-	-	-	-	-	2.8	-	2.7	3.0

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
			✓		

COURSE OBJECTIVES:

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

- Categorize effect of using the sources on the environment and climate.
- List the various the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment.
- Explain the concepts of green buildings.
- Explain the basics of energy system and resources.
- List and describe the primary renewable energy resources and technologies.

UNIT I	INTRODUCTION TO ENERGY SCIENCE	9
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Scientific principles and historical interpretation - to place energy use in the context of pressing societal, environmental and climate issues - Introduction to energy systems and resources - Introduction to Energy, sustainability & the Environment.

UNIT II	ENERGY SOURCES	9
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Overview of energy systems, sources, transformations, efficiency, and storage - Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade - offs of different energy systems - possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries)

UNIT III	ENERGY & ENVIRONMENT	9
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Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development - Carbon footprint, energy consumption and sustainability - introduction to the economics of energy - How the economic system determines production and consumption - linkages between economic and environmental outcomes - How future energy use can be influenced by economic, environmental, trade, and research policy

UNIT IV	CIVIL ENGINEERING PROJECTS CONNECTED WITH THE ENERGY SOURCES	9
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Coal mining technologies, Oil exploration offshore platforms, Underground and under - sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers - hydro power stations above - ground and underground along with associated dams, tunnels, penstocks, etc., - Nuclear reactor containment buildings and associated buildings, design and construction constraints and testing procedures for reactor containment buildings - Spent Nuclear fuel storage and disposal systems

UNIT V ENGINEERING FOR ENERGY CONSERVATION**9**

Concept of Green Building and Green Architecture – Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated) – LEED ratings – Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates – Embodied energy analysis and use as a tool for measuring sustainability – Energy Audit of Facilities and optimization of energy consumption.

Total: 45 Hours**TEXT BOOKS:**

- T1: Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University
- T2: Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press
- T3: Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living,

REFERENCE BOOKS:

- R1: Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, XVIII,
- R2: Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, John Wiley
- R3: UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment
- R4: E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc21_ph33/preview
2. https://onlinecourses.nptel.ac.in/noc22_hs43/preview
3. https://onlinecourses.swayam2.ac.in/nou20_cs09/preview
4. https://onlinecourses.swayam2.ac.in/nou21_ge33/preview

COURSE OUTCOMES

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

C01:	Relate main sources of energy and their primary applications	K2
C02:	Outline and understand effect of using energy sources on the environment and climate	K2
C03:	Compare and contrast impacts associated with the use of various energy sources on environment	K4
C04:	Design Civil engineering projects utilizing energy sources	K3
C05:	Assess and Plan energy conservation and optimization for energy consumption	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS 01	PS 02
C01	1	1	1	1	-	3	2	1	-	1	-	3	2	2
C02	2	1	1	2	-	3	2	2	1	1	-	3	2	1
C03	2	2	2	2	-	3	3	2	1	2	-	3	2	2
C04	3	2	3	2	2	3	3	3	3	3	2	2	3	3
C05	2	2	3	2	2	3	3	2	3	3	2	2	3	3
Average	2.0	1.6	2.0	1.8	2.0	3.0	2.6	2.0	2.0	2.0	2.0	2.6	2.4	2.2

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
	✓		✓		

COURSE OBJECTIVES

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

- To understand the basic properties of the fluid and principles of fluid kinematics and fluid dynamics
- To analyse the complexities involved in solving the fluid flow problems

UNIT I FLUID PROPERTIES**12**

Fluid – Definition, Distinction between Solid and Fluid - Units and dimensions - Properties of fluids - Density, Specific weight, Specific volume, Specific gravity, viscosity, compressibility, Vapour pressure, Capillarity and Surface tension, Bulk Modulus- Applications

UNIT II FLUID STATICS**12**

Concept of Fluid Static Pressure, Pascal's law- Absolute and gauge pressures - Pressure measurements by Manometers-Forces on planes – Centre of pressure – Buoyancy and floatation- Metacentre- Stability of floating and submerged bodies.

UNIT III FLUID KINEMATICS AND DYNAMICS**12**

Fluid Kinematics – Classification and types of flow - Velocity field and Acceleration - Continuity equation (One and Three dimensional differential forms) - Stream line-Streak line-Path line- Stream function - Velocity potential function - Flow net.

Fluid dynamics - Equations of motion -Euler's equation along a streamline - Bernoulli's equation – Applications - Venturimeter, Orificemeter and Pitot tube- Linear momentum equation and its application to pipe bend.

UNIT IV FLOW THROUGH PIPES**12**

Definition of Boundary layer- Reynold's experiment - laminar flow through circular pipe (Hagen poiseuille's) - hydraulic and energy gradient – Flow through pipes - Darcy - Weisbach's equation - Pipe roughness -Friction factor- Moody's diagram- Major and Minor losses of flow in pipes - Pipes in series and in parallel- Equivalent pipe.

UNIT V DIMENSIONAL ANALYSIS AND MODEL STUDIES**12**

Fundamental dimensions - Dimensional homogeneity - Rayleigh's method and Buckingham Pi- theorem - dimensionless parameters - Similitudes and model studies - Distorted models.

TOTAL: 60 hours

TEXT BOOKS:

T1: Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 2013

T2: Subramanya.K " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.

T3: Rajput.R.K. "Fluid Mechanics", S.Chand and Co, New Delhi, 2008.

REFERENCE BOOKS:

R1: Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.

R2: Jain.A.K., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.

R3: Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.

WEB LINKS:

1. <https://nptel.ac.in/courses/105105168>
2. <https://nptel.ac.in/courses/105103207>

COURSE OUTCOMES

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

C01:	Apply the basic properties of fluids and apply Newton's Law of Viscosity in solving practical Problems	K4
C02:	Determine the forces and pressure acting on surfaces and hydraulic structures, floatation and stability of floating bodies like boats, ships, naval vessels etc.	K3
C03:	Apply the principles of kinematics with specific emphasis on application of continuity equation, stream function and determine the discharge by using Bernoulli's equation	K4
C04:	Determine the major, minor and equivalent losses in pipe	K3
C05:	Understand the fundamentals of dimensional analysis and model studies	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	2	1	2	2	-	-	-	-	-	-	-	3	-	2
C02	2	2	2	2	-	-	-	-	-	-	-	3	-	2
C03	3	2	3	3	-	-	-	-	-	-	-	3	2	3
C04	3	3	3	3	-	-	-	-	-	-	-	3	2	3
C05	3	2	3	3	-	-	-	-	-	-	-	3	2	3
Average	2.6	2.0	2.6	2.6	-	-	-	-	-	-	-	3.0	2.0	2.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
			✓	✓	

COURSE OBJECTIVES:

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

- To learn fundamental concepts of stress, strain and deformation of solids with applications to bars, beams and thin cylinders.
- To analyse a complex two dimensional state of stress and plane trusses
- To understand the effect of torsion on shafts and springs.
- To learn the advanced topics in the bending of beams with the stress distribution in thin and thick cylinders.

UNIT I SIMPLE STRESSES AND STRAINS**15**

Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them –Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience– Gradual, sudden, impact and shock loadings – simple applications.

UNIT II COMPOUND STRESSES AND STRAINS**15**

Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants

UNIT III FLEXURAL STRESSES AND SHEAR STRESSES**15**

Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis – Determination of bending stresses –Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections. Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT IV TORSION**9**

Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.

UNIT V THIN CYLINDERS AND SPHERES**6**

Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

TOTAL: 60 hours

TEXT BOOKS:

- T1: Rajput R.K, "Strength of Materials", S.Chand & Company Ltd., New Delhi, 2014.
- T2: Bansal R.K., "Strength of Materials", Laxmi Publications, New Delhi - Fifth Edition, 2012.
- T3: Punmia B.C, Ashok Kumar Jain, Arun Kumar Jain, "Mechanics of Material", Laxmi Publications, Reprint, 10th Edition, 2009.

REFERENCE BOOKS:

- R1: Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 2nd Edition, 2003.
- R2: Timoshenko.S.P and Gere.J.M, "Mechanics of Materials", A&C, Black 2 Ed. 1990.
- R3: Srinath L.S, "Advanced Mechanics of Solids", Tata McGraw-Hill Publishing Co., New Delhi, 2009.
- R4: Subramanian R., "Strength of Materials", Oxford university press, New Delhi, 2011.
- R5: Bhavikatti, S.S., "Solid Mechanics", Vikas publishing -2010

WEB LINKS:

1. http://esag.harvard.edu/rice/e0_Solid_Mechanics_94_10.pdf
2. <https://nptel.ac.in/courses/112102284>

COURSE OUTCOMES:

C01:	Infer the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law	K2
C02:	Analyze the state of stress (two and three dimensional) and evaluate the principal stresses and principal planes by analytical and graphical treatment	K4
C03:	Understand in detail regarding, analysis of stress distribution in symmetrical and unsymmetrical sections of beams	K2
C04:	Solve the torsion problems in bars and thin walled members and understand the shear stress distribution in different section and calculate the stresses and deformation of spring.	K3
C05:	Interpret the concepts of principal stress and strain in cylinders	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C01	2	2	2	2	-	-	-	-	-	-	-	3	1	1
C02	2	2	2	2	-	-	-	-	-	-	-	3	2	1
C03	3	2	3	3	-	-	-	-	-	-	-	3	2	-
C04	3	3	3	3	-	-	-	-	-	-	-	3	2	1
C05	3	3	3	3	-	-	-	-	-	-	-	3	2	1
Average	2.6	2.4	2.6	2.6	-	-	-	-	-	-	-	3.0	1.8	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
				✓	

COURSE OBJECTIVES

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

- To understand the principle of work and energy, laws of motion and kinematics of motion
- To understand the vector and scalar representation of forces and moment and the effect of friction
- To understand the significance of properties of surfaces and solids.

UNIT I	BASICS AND STATICS OF PARTICLES	9
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Introduction – Units and Dimensions – Laws of Mechanics – Lamé's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II	EQUILIBRIUM OF RIGID BODIES	9
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Free body diagram – Types of supports and their reactions – requirements of 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 – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III	PROPERTIES OF SURFACES AND SOLIDS	9
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Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV	DYNAMICS OF PARTICLES	9
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Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V	FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS	9
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Frictional force – Laws of Coulomb friction – simple contact friction – Rolling resistance – Belt friction- Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

List of Exercises

1. Law of Polygon of Forces
2. Bending of a simple beam
3. Torque
4. Rolling Friction
5. Sliding Friction

TOTAL: 45 + 15 hours

TEXT BOOKS:

T1: Rajasekaran. S, Sankarasubramanian. G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., 2000.

T2: Punmia.B.C, Ashok Kumar Jain, Arun Kumar Jain, "*Mechanics of Materials*", Laxmi Publications (P) Ltd., 2003.

REFERENCE BOOKS:

R1: Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.

R2: Palanichamy, M.S., Nagan, S., "Engineering Mechanics – Statics and Dynamics", Tata McGraw-Hill, 2001.

R3: Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., 2003.

WEB LINKS:

1. <https://nptel.ac.in/courses/112103108>
2. <https://nptel.ac.in/courses/112103109>

COURSE OUTCOMES

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

C01:	Solve engineering problems dealing with force, displacement, velocity and acceleration	K3
C02:	Solve rigid body subjected to dynamic forces	K3
C03:	Use of scalar and vector analytical techniques for analyzing the forces in statically determinate structures.	K2
C04:	Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.	K3
C05:	Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals	K2

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	2	1	2	2	-	-	-	-	-	-	-	3	-	2
C02	2	2	2	2	-	-	-	-	-	-	-	3	-	2
C03	3	2	3	3	-	-	-	-	-	-	-	3	2	3
C04	3	3	3	3	-	-	-	-	-	-	-	3	2	3
C05	3	2	3	3	-	-	-	-	-	-	-	3	2	3
Average	2.6	2.0	2.6	2.6	-	-	-	-	-	-	-	3.0	2.0	2.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Record
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Viva	Demonstration / Presentation	Open Book Test
			✓	✓	

22CMC035	STRENGTH OF MATERIALS LABORATORY	L	T	P	Credits
		0	0	2	1

COURSE OBJECTIVES:

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

- To study the properties of materials when subjected to different types of loading
- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally
- To determine the relationship between the stress and strain on deformable solids, to analyse the members subjected to axial, bending and torsion loads

LIST OF EXPERIMENTS

1. Tension test on mild steel / tor steel rod (Tensile strength-Density-Proof Stress- Stress Strain Curve -Young's Modulus)
2. Compression test on wood
3. Double shear test on Steel
4. Torsion test on mild steel rod
5. Impact test on metal specimen
6. Hardness test on metals
7. Deflection test on Steel beam
8. Compression test on helical spring
9. Deflection test on carriage spring
10. Tests on bricks, concrete cubes and tiles - Demonstration only

TOTAL: 30 hours

REFERENCE BOOKS

- R1: Punmia P.C, Ashok Kumar Jain, Arun Kumar Jain, "Mechanics of Material", Laxmi Publications, Reprint Edition, 2009.
- R2: Bansal R.K., "Strength of Materials", Laxmi Publications, New Delhi, Revised Fourth Edition, 2010.
- R3: William A. Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series", TataMcGraw-Hill Publishing Co., New Delhi, 4th Edition, 2008.

COURSE OUTCOMES:

C01:	Develop an understanding of the concepts of tension test on mild steel / tor steel rod and compression test on wood	K3
C02:	Examine the concept of double shear test and torsion test on steel	K3
C03:	Test for the impact and hardness of metal specimen	K4
C04:	Examine the deflection properties of steel beam	K4
C05:	Determine the stress by performing compression test on helical spring and also carriage spring	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P O 11	PO 12	PSO 1	PSO 2
C01	2	3	1	1	2	-	1	-	2	2	-	2	2	1
C02	3	3	2	2	2	-	1	1	3	3	-	3	2	-
C03	3	3	2	2	2	-	1	1	3	3	-	3	3	-
C04	3	3	2	2	2	-	1	1	3	3	-	3	2	-
C05	3	3	2	2	2	-	1	-	3	3	-	3	3	1
Average	2.8	3.0	1.8	1.8	2.0	-	1.0	3.0	2.8	2.8	-	2.8	2.4	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓			✓	✓

COURSE OBJECTIVES:

- To enable the student to explore the knowledge on components, function and uses of different types of pumps and turbine
- To study the measurement of velocity and discharge using weirs, notches, venturimeter and orificemeter

Any Eight Experiments

1. Determination of co-efficient of discharge for orifice
2. Determination of co-efficient of discharge for notches
3. Determination of co-efficient of discharge for venturimeter
4. Determination of co-efficient of discharge for orifice meter
5. Study of friction losses in pipes
6. Study of minor losses in pipes
7. Study on performance characteristics of Pelton turbine.
8. Study on performance characteristics of Francis turbine
9. Study on performance characteristics of Kaplan turbine
10. Study on performance characteristics of Centrifugal pumps (Constant speed / variable speed)
11. Study on performance characteristics of reciprocating pump.
12. Study on performance characteristics of Gear oil pump.
13. Study on performance characteristics of submersible pump.

Total: 30 Hours**TEXT BOOKS:**

- T1: Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 2013
- T2: Subramanya.K " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
- T3: Rajput.R.K. "Fluid Mechanics", S.Chand and Co, New Delhi, 2008.

REFERENCE BOOKS:

- R.1. Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
- R.2. Jain.A.K., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.

COURSE OUTCOMES

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

C01:	Determine the coefficient of discharge in pipes through venturimeter and orifice meter	K3
C02:	Determine the coefficient of discharge by rectangular and triangular notches	K3
C03:	Determine the losses due to expansion, contraction and bends and losses in pipes	K3
C04:	Analyze the performance characteristics of Pelton, Kaplan and Francis turbines	K4
C05:	Analyze the efficiencies of centrifugal pump, reciprocating pump, Gear oil pump, submersible pump	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P O 11	PO 12	PSO 1	PSO 2
C01	2	3	1	1	2	-	1	-	2	2	-	2	2	1
C02	3	3	2	2	2	-	1	1	3	3	-	3	2	-
C03	3	3	2	2	2	-	1	1	3	3	-	3	3	-
C04	3	3	2	2	2	-	1	1	3	3	-	3	2	-
C05	3	3	2	2	2	-	1	-	3	3	-	3	3	1
Average	2.8	3.0	1.8	1.8	2.0	-	1.0	1.0	2.8	2.8	-	2.8	2.4	1.0

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓			✓	✓

COURSE OBJECTIVES (Skill Development):

- To nurture and develop winning personalities and eventually leading them to become dynamic and socially responsible leaders

UNIT I SOFT SKILLS I

6

Introduction to Personality Development – Meaning–Features of personality – Dimensions of Personality
Determinants of Personality–Features and Traits– Components of self concept–Barriers–Self analysis

UNIT II SOFT SKILLS II

6

Importance of Soft Skills – First impression–Work Place requirements–Discipline –Cleanliness Hygiene – general Appearance--Building Confidence—Concept of Thinking and Usage –Value of Time–Focus & Commitment.

UNIT III SOFT SKILLS IN ACTION

6

Grooming – Attire – Understanding others– Stability & Maturity Development – Strength s – Weakness – Opportunities–threats – Merits of SWOT Analysis – Components – how to convert weakness into strengths – Goal settings

UNIT IV SELF AWARENESS AND SELF ESTEEM

6

Definitions – Components of Self awareness – Developing Self awareness – Self esteem – meaning –Steps to improve self esteem.

UNIT V SELF MOTIVATION

6

Motivation – Meaning –Techniques of self motivation–Motivation & goal setting – Motivation and emotion – Motivation at work.

TOTAL: 30 Hours

TEXT BOOKS:

- T1: Personality Development And Soft Skills Barun K Mitra, Oxford Publication
T2: Seven habits of Highly Effective people – Stephen R. Covey

REFERENCE BOOKS:

- R1: Emotion, motivation and Self regulation – Nathan C. Hall, McGill University, Canada Thomas Goetz, University of Konstanz, Germany <http://www.emeraldgroupublishing.com>.
- R2: Psychology of Self esteem – Nathaniel Branden, Nash (1st edition), Jossey – Bass (32 nd anniversary edition)

WEBLINKS:

1. <https://www.educations.com/articles-and-advice/soft-skills-you-need-to-get-ahead-14193>

COURSE OUTCOMES

C01:	Discuss the features, dimensions and determinants of personality	K2
C02:	Make a good first impression in professional and other situations	K3
C03:	Demonstrate confidence, punctuality and commitment as an engineer	K3
C04:	Set goals for development using SWOT analysis	K5
C05:	Develop self-awareness and improve self esteem	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS 0 1	PS 0 2
C01	-	-	-	-	-	-	-	-	2	2	-	3	2	-
C02	-	-	-	-	-	-	-	-	3	3	-	3	2	-
C03	-	-	-	-	-	-	-	-	2	2	-	3	-	-
C04	-	-	-	-	-	-	-	1	2	2	-	3	2	-
C05	-	-	-	-	-	-	-	1	2	2	-	3	2	-
Average	-	-	-	-	-	-	-	1.0	2.2	2.2	-	3.0	2.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓	✓	✓	✓	✓	

COURSE OBJECTIVE

- To provide value education to improve the students' character, understanding of principled life, physical health, maintaining youthfulness, measures and methods in five aspects of life.

UNIT I	PHYSICAL HEALTH	6
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Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment. Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits. Yogasanas: Pranamasana - HasthaUttanasana - PadaHasthasana - AswaSanjalana Asana - ThuvipathaasvaSanjalana asana - AstangaNamaskara - Bhujangasana - AthaMukthaSavasana - AswaSanjalana Asana - PadaHasthasana - HasthaUttanasana - Pranamasana. Pranayama: Naddisuddi - Clearance Practice - Benefits.

UNIT II	LIFE FORCE	6
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Reasons for Diseases - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds). Philosophy of Kaya kalpa - Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind. Maintaining youthfulness. Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid Measure and method in five aspects of life - Controlling undue Passion. Kayakalpa practice - Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III	MENTAL HEALTH	6
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Mental Frequencies - Beta, Alpha, Theta and Delta wave - Agna Meditation explanation - benefits. Shanthi Meditation explanation - Benefits - Thuriya Meditation explanation - Benefit. Benefits of Blessing - Self blessing (Auto suggestion) - Family blessing - Blessing the others - World blessing - Divine protection

UNIT IV	VALUES	6
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Human Values Self-control - Self-confidence - Honesty Contentment - Humility - Modesty Tolerance - Adjustment - Sacrifice - Forgiveness Purity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual purity Social Values: Non-violence - Service Patriotism - Equality Respect for parents and elders - care and protection - Respect for teacher Punctuality - Time Management.

UNIT V	MORALITY (VIRTUES)	6
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Importance of Introspection - I - Mine (Ego, Possessiveness). Six Evil Temperaments - Greed - Anger - Miserliness - Immoral sexual passion - Inferiority and superiority Complex - Vengeance. Maneuvering of Six Temperaments - Contentment - Tolerance - Charity - Chastity - Equality - Pardon (Forgiveness). Five

essential Qualities acquired through Meditation: Perspicacity - Magnanimity - Receptivity - Adaptability – Creativity. Improved Memory Power - Success in the Examination.

TOTAL: 30 Hours

TEXT BOOKS:

- T1: Vethathiri Maharishi, 16th Edi.2013, Yoga for Modern Age, Vethathiri Publications, Erode.
 T2: Vethathiri Maharishi, 2014, Simplified Physical Exercises, Vethathiri Publications, Erode.
 T3: Vethathiri Maharishi, 3rd Edi.2014, Kayakalpam, Vethathiri Publications, Erode.
 T4: Rev.Dr.G.U. Pope, 2016, Thirukkural, Giri Trading Agency,
 T5: Vethathiri Maharishi, 1994, Mind, Vethathiri Publications, Erode.

REFERENCE BOOKS

- R1: Chandrasekaran.K, 1999, Sound Health through yoga, Sedapati, Tamilnadu, Premkalyan Publications.
 R2: Iyengar, B.K.S. 2008, Light on Yoga, Noida, UP India, Harber Collins Publishing India Ltd.,
 R3: K. R. Dhanalakshmi and N. S. Raghunathan, “ Personality Enrichment, Margham Publications
 R4: D.r V. M. Selvaraj, “Personality Development” Bhavani Publications
 R5: R. S. Agarwal, “Quantitative Aptitude”.
 R6: A.K Gupta, “Logical and Analytical Reasoning (English)”, 30th Edition.

COURSE OUTCOME:

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

C01:	Utilize skills developed through participation in Manavalakalai (SKY) Yoga to help maintain lifelong health and fitness	K3
C02:	Demonstrate foundational standing, sitting, balance postures with proper alignment andMaintain youthfulness through kaya kalpa practice	K2
C03:	Explore relaxation techniques to observe thoughts and to manage emotions and stress, and reflect on those techniques which are most effective to them	K3
C04:	Demonstrate an understanding of anatomy and physiology as it applies to the intentional integration of breath, postures, and movement within the practice of yoga to understand the human values	K2
C05:	Achieve a greater sense of awareness, wisdom, introspection, and a deeper sense of relaxation through meditation to keep up morality in life	K3

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	-	-	-	-	-	3	3	2	3	-	-	3	2	-
C02	-	-	-	-	-	3	2	2	3	-	-	3	2	-
C03	-	-	-	-	-	3	3	2	3	-	-	3	2	-
C04	-	-	-	-	-	3	2	2	3	-	-	3	2	-
C05	-	-	-	-	-	3	3	3	3	-	-	3	2	-
Average	-	-	-	-	-	3.0	2.6	2.2	3.0	-	-	3.0	2.0	-

ASSESSMENT METHODS

CAT1	CAT2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/Presentation	Open book test
			✓		

22CMC041	BIOLOGY FOR ENGINEERS	L	T	P	Credits
		2	0	0	2

COURSE OBJECTIVE

- To convey that classification of biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.

UNIT I CLASSIFICATION 6

Important aspects of biology for engineering – Why study biology? – Major discoveries of 18th century – Morphological, biochemical or ecological classification – Classification based on cellularity, structure, energy, ammonia excretion and molecular taxonomy – E.Coli, S. Cerevisiae and C. Elegance

UNIT II GENETICS 6

Mendel's laws, Concept of segregation and independent assortment, Concept of allele, Genemapping, Gene interaction, Epistasis, Meiosis and Mitosis - Concepts of recessiveness and dominance – Concept of mapping of phenotype to genes - single gene disorders in humans.

UNIT III ENZYMES & BIOMOLECULES 6

Monomeric units and polymeric structures - Sugars, starch and cellulose - Amino acids and proteins - Nucleotides and DNA/RNA - Two carbon units and lipids. Enzyme catalysed reactions – Mechanism of enzyme action – Enzyme kinetics and kinetic parameters – RNA Catalysis

UNIT IV PROTEINS & INFORMATION TRANSFER 6

Proteins- structure and function - Hierarchy in protein structure - Primary secondary, tertiary and quaternary structure - Proteins as enzymes, transporters, receptors and structural elements – Molecular basis of information transfer – Concept of genetic code – Hierarchy of DNA

UNIT V METABOLISM 6

Exothermic and endothermic versus endergonic and exergonic reactions. Concept of K_{eq} and its relation to standard free energy – Spontaneity - ATP as an energy currency - Energy yielding and energy consuming reactions - Concept of Energy charge – Growth Kinetics

Total: 30 Hours

TEXT BOOKS:

- T1: Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
- T2: Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

REFERENCE BOOKS:

- R.1. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
- R.2. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc19_ge31
2. https://www.youtube.com/watch?v=oyqQCb0H_QQ

COURSE OUTCOMES

CO1:	Summarize the various classification of biology and infer the importance of biology in engineering	K2
CO2:	Explain the concepts of recessiveness and dominance	K2
CO3:	Classify enzymes and distinguish between different mechanisms of enzyme action	K2
CO4:	Interpret the role of proteins in information transfer and identify the role of DNA in information transfer	K2
CO5:	Classify and compare the various types of reactions and their role in metabolism	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS01	PS02
C01	3	1	-	-	-	-	-	-	-	-	-	-	2	1
C02	3	-	-	-	-	-	-	-	-	-	-	-	1	-
C03	3	-	-	-	-	-	-	-	-	-	-	-	1	-
C04	3	1	-	-	-	-	-	-	-	-	-	-	1	1
C05	3	1	-	-	-	-	-	-	-	-	-	-	-	-
Average	3.0	1.0	-	-	-	-	-	-	-	-	-	-	1.3	1.0

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
			✓	✓	

22CMC042	SURVEYING & GEOMATICS	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- Develop the rudiments of surveying and geodetic principles to Geoinformatics Engineers.
- List the various methods of plane and geodetic surveying to solve the real world problems.
- Explain the concepts of Control Surveying,
- Explain the basics of Astronomical Surveying,
- Categorize the working of modern surveying equipment and solve the surveying problems.

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING 9

Classifications and basic principles of surveying – Chain survey – Basic principles and applications of Plane Table and Compass - Levels and staves - Methods of levelling - Booking - Reduction - Curvature and refraction - Contouring.

UNIT II THEODOLITE SURVEYING 9

Horizontal and vertical angle measurements - Temporary and permanent adjustments – Heights and distances–Tachometric surveying – Trigonometric levelling – Horizontal curves in route surveying – classification, functions and requirements - methods of setting out simple curves.

UNIT III CONTROL SURVEYING AND ADJUSTMENT 9

Horizontal and vertical control- Methods - Triangulation- Base line - Instruments and accessories – Corrections - Satellite station - Traversing. Concepts of measurements and errors – Photogrammetry Surveying –Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping.

UNIT IV MODERN FIELD SURVEYING 9

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments – Distomat – Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

UNIT V REMOTE SENSING 9

Introduction –Electromagnetic Spectrum– interaction of electromagnetic radiation with the atmosphere and earth surface – remote sensing data acquisition – platforms and sensors – visual image interpretation – digital image processing.

Total: 45 Hours

TEXT BOOKS:

- T1: T.P. Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.
- T2: Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005.
- T3: S.S.Bhavikatti, Surveying Theory and Practice, I.K.International Publishing House Pvt. Ltd, New Delhi, 2010.
- T4: Satheesh Gopi, rasathishkumar, Nmadhu, “ Advanced Surveying , Total Station GPS and Remote Sensing “ Pearson education , 2007

REFERENCE BOOKS:

- R1: R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
- R2: S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice' Hall of India 2004 5. K.R. Arora, Surveying Vol I & II, Standard Book house , Twelfth Edition. 2013
- R3: Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
- R4: Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin, 1998.

WEB LINKS

1. <https://www.youtube.com/watch?v=TqbYlHizYIs&list=PLwdnzlV3ogoXXrcA8w6rrYmXfq3uU4R7g>
2. https://onlinecourses.nptel.ac.in/noc20_ce16/preview
3. https://books.google.co.in/books/about/Higher_Surveying.html?id=aLhW8Eq2W2sC

COURSE OUTCOMES

C01:	Acquire the fundamental knowledge and concepts of surveying techniques.	K2
C02:	Apply the skills of basic surveying measurement.	K3
C03:	Understand the behavior of infrastructural development project.	K2
C04:	Understand the impacts of landcover on engineering project.	K2
C05:	Differentiate the concepts of Higher surveying and geomatics.	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	3	1	1	1	1	-	-	-	-	-	-	-	1	1
C02	3	2	2	3	3	-	-	-	-	-	-	-	2	2
C03	2	2	1	1	1	-	-	-	-	-	-	-	1	2
C04	3	1	2	3	2	-	-	-	-	-	-	-	2	2
C05	1	1	1	2	1	-	-	-	-	-	-	-	2	2
Average	2.4	1.4	1.4	2.0	1.6	-	-	-	-	-	-	-	1.6	1.8

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
			✓	✓	

		L	T	P	Credits
22CMC043	MECHANICS OF MATERIALS	3	0	0	3

COURSE OBJECTIVES:

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

- To learn the computation of deflection of beams and trusses using energy principles,
- Analysis of indeterminate beams and columns, state of stress in three dimensions
- Advanced topics in the bending of beams with the stress distribution in thin and thick cylinders.

UNIT I ENERGY PRINCIPLES 9

Generalized state of stress and strain tensor, Yield criteria and theories of failure; Tresca, Von-Mises, Hill criteria, Heigh-Westerguard's stress space. Strain Energy and Strain Energy Density – Strain Energy in Traction, Shear in Flexure and Torsion –Castigliano's Theorems – Principle of Virtual Work Application of Energy Theorems for Computing Deflections in Beams and Trusses – Maxwell's Reciprocal Theorems

UNIT II TRANSVERSE LOADING ON BEAMS 9

Beams – types of supports – simple and fixed, types of load – concentrated, uniformly distributed, varying distributed load, combination of above loading – relationship between bending moment and shear force – bending moment, shear force diagram for simply supported, cantilever and overhanging beams – Theory of simple bending – analysis of stresses - proportioning of sections

UNIT III DEFLECTION OF BEAMS 9

Types of Beams- Deflection of beams – Deflection of beams by double integration method –Deflection of beams by Macaulay's method – Slope and deflection using moment area method, Slope and deflection using Conjugate Beam method for various loading conditions.

UNIT IV INDETERMINATE BEAMS 9

Propped Cantilever beam Reactions due to lateral loads shear force & bending moment and Fixed Beams Reactions due to lateral loads shear force & bending moment - Fixed End Moments and Reactions due to lateral loads Theorem of Three Moments – Analysis of Continuous Beams (limited two unknowns).

UNIT V COLUMNS 9

Eccentrically Loaded Short Columns – Middle Third Rule – Core Section – Columns of Unsymmetrical Sections – Euler's Theory of Long Columns – Critical Loads for Prismatic Columns with Different End Conditions; Rankine-Gordon Formula for Eccentrically Loaded Columns.

TOTAL: 45 hours

TEXT BOOKS:

T1: Rajput R.K, "Strength of Materials", S.Chand & Company Ltd., New Delhi, 2014.

T2: Punmia B.C, Ashok Kumar Jain, Arun Kumar Jain, “Mechanics of Material”, Laxmi Publications, Reprint 10th Edition, 2009.

REFERENCE BOOKS:

R1: William A.Nash, “Theory and Problems of Strength of Materials, Schaum”s Outline Series”, Tata McGraw-Hill Publishing Co., New Delhi,4th Edition, 2008.

R2: Srinath L.S, “Advanced Mechanics of Solids”, Tata McGraw-Hill Publishing Co., New Delhi, 3rd Edition, 2009.

R3: Egor P Popov, “Engineering Mechanics of Solids”, Prentice Hall of India, New Delhi, 2nd Edition, 2003.

R4: Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.

R5: Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004

WEBLINKS:

1. <https://nptel.ac.in/courses/105106172>
2. <https://nptel.ac.in/courses/105106049>

COURSE OUTCOME

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

CO 1	Interpret the energy principles, their use in the analysis of structures	K2
CO 2	Draw the SFD and BMD for various types of beams	K3
CO 3	Determine the deflection of beams by various methods	K4
CO 4	Analyze the moments and reactions in indeterminate beams	K4
CO 5	Solve the analytic methods used in connection with the structural design of columns, long mechanical members under compression	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	2	1	-	-	-	-	-	-	3	1	1
CO2	2	2	2	2	1	-	-	-	-	2	-	3	2	1
CO3	3	2	3	3	1	-	-	-	-	1	-	3	2	1
CO4	3	3	3	3	1	-	-	-	-	2	-	3	2	1
CO5	3	3	3	3	1	-	-	-	-	1	-	3	2	1
Average	2.6	2.4	2.6	2.6	1.0	-	-	-	-	1.5	-	3.0	1.8	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
✓	✓			✓	

		L	T	P	Credits
22CMC044	DISASTER PREPAREDNESS & PLANNING	2	0	0	2

COURSE OBJECTIVES:

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

- To identify the various types of disaster and its management process.
- To understand the importance of the mitigation and other agencies.

UNIT I INTRODUCTION 4

Introduction - Concepts and definitions: disaster, hazard, vulnerability, risk-severity, frequency and details, capacity, impact, prevention, mitigation).

UNIT II TYPES OF DISASTERS 8

Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III DISASTER IMPACTS 6

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT IV MITIGATION 6

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V ENVIRONMENTAL EFFECTS 6

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

TOTAL: 30 hours

TEXT BOOKS:

T1: Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.

T2: Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.

REFERENCE BOOKS:

R1: Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

R2: Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003

R3: Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

WEBLINKS:

1. https://onlinecourses.nptel.ac.in/noc20_ce07/preview
2. <https://ndma.gov.in/>

COURSE OUTCOMES:

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

CO 1	Compare and Contrast the effects, causes of natural and manmade disaster	K3
CO 2	Summarize the various impacts of a disaster	K2
CO 3	Interpret the effects of climate change on disaster	K2
CO 4	Develop a Disaster Management Cycle for a disaster	K3
CO 5	Make use of reconstruction and development methods to examine the environmental effects	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C01	2	1	-	1	-	2	1	-	1	1	-	2	2	-
C02	1	-	-	1	-	3	1	-	-	2	-	3	1	-
C03	3	2	3	2	2	3	1	-	-	1	-	3	1	-
C04	3	3	3	3	1	3	1	1	1	2	-	3	3	3
C05	2	2	1	1	2	3	2	1	1	1	-	3	3	2
Average	2.2	2.0	2.4	1.6	1.7	2.8	1.2	1.0	1.0	1.4	-	2.8	2.0	2.5

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
✓	✓			✓	✓

COURSE OBJECTIVES

- To give exposure to planning of roadways and to develop skills on planning and design of flexible and rigid pavements
- To give exposure on materials used for highways and construction procedures. To have basic knowledge on pavement evaluation

UNIT I	HIGHWAY PLANNING AND ALIGNMENT	9
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Highway Development in India - Jayakar Committee Recommendations and Realisations, - Indian Roads Congress, Highway Research Board, National Highway Authority of India, Ministry of Road Transport and Highways (MORTH) and Central Road Research Institute. Requirements of Ideal Alignment, Factors Controlling Highway Alignment, Engineering Surveys for Alignment - Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements – Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths [IRC Standards].

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Design of Horizontal Alignment – Horizontal Curves, Super elevation, Widening of Pavements on Horizontal Curves and Transition Curves, Design of Vertical Alignments –Summit and Valley Curves-Sight Distances - Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections [Problems in SSD and OSD].

UNIT III FLEXIBLE, RIGID PAVEMENTS AND THEIR CONSTRUCTION PRACTICE 9

Rigid and Flexible Pavements- Components and their Functions -Design Principles of Flexible and Rigid Pavements - Design Practice for Flexible Pavements [IRC Method and Recommendations- Problems] - Design Practice for Rigid Pavements – IRC Recommendations - concepts only. Construction Practice - Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications]

UNIT IV	HIGHWAY MATERIALS	9
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Desirable Properties and Testing of Highway Materials: Soil – California Bearing Ratio Test, Field Density Test - Aggregate - Crushing, Abrasion, Impact Tests, Water absorption, Flakiness and Elongation indices and Stone polishing value test - Bitumen - Penetration, Ductility, Viscosity, Binder content and Softening point Tests.

UNIT V	HIGHWAY MAINTENANCE	9
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Types of defects in Flexible pavements – Surface defects, Cracks, Deformation, Disintegration, Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural Cracks Spalling of Joints and Mud Pumping – and Special Repairs. - Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening - Overlay design by Benkelman Beam Method [Procedure only].

TEXT BOOKS:

- T1: Khanna S K, Justo C E G and A. Veeraraghavan, "Highway Engineering", Khanna Publishers, Roorkee, 10th edition, 2015.
- T2: Kadiyali L R, "Principles and Practice of Highway Engineering", Khanna Technical Publications, Delhi, 2012.

REFERENCE BOOKS:

- R1: C.S. Papacostas, P.D. Prevedouros, "Transportation Engineering & Planning", Prentice Hall of India Pvt Ltd, 2006.
- R2: IRC Standards (IRC 37 - 2001 & IRC 58 -1998)
- R3: Bureau of Indian Standards (BIS) Publications on Highway Materials

WEBLINKS:

1. <https://www.crridom.gov.in/>
2. <https://nptel.ac.in/courses/105105107>
3. <https://nptel.ac.in/courses/105101087>

COURSE OUTCOMES

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

CO 1	Outline a highway with Highway Cross Sectional Elements	K2
CO 2	Apply the sight distance and superelevation concepts in horizontal and vertical alignment of roads	K3
CO 3	Design a flexible pavement as per IRC guideline	K3
CO 4	Interpret the results of highway materials and develop a procedure for pavement construction	K2
CO 5	Infer the causes of pavement failures and suggest a remedial measure	K2

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
C01	-	-	2	2	2	3	2	2	-	2	-	2	3	2
C02	3	3	2	2	3	3	1	1	1	2	-	3	2	1
C03	2	2	2	2	3	3	2	2	2	2	1	2	3	1
C04	1	1	1	3	2	3	3	1	2	1	2	2	3	3
C05	2	2	1	2	2	3	3	1	-	1	1	2	2	3
Average	2.0	2.0	1.6	2.2	2.4	3.0	2.2	1.4	1.7	1.6	1.4	2.2	2.6	2

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
✓	✓				✓

		L	T	P	Credits
22CMV046	ENGINEERING GEOLOGY	3	0	2	4

COURSE OBJECTIVES

- To understand the importance of geological knowledge such as structure of the earth, earthquake, and volcanoes.
- To apply these fundamental knowledge in Civil engineering projects such as dams, tunnels, bridges, roads, airport and harbor

UNIT I	PHYSICAL GEOLOGY	9
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Geology in civil engineering – branches of geology – structure of earth and its composition weathering of rocks – scale of weathering – soils – landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India

UNIT II MINEROLOGY 9

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

UNIT III PETROLOGY 9

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

UNIT IV	STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS	9
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Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

UNIT V	APPLICATION OF GEOLOGICAL INVESTIGATIONS	9
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Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings – Hydrogeological investigations and mining – Coastal protection structures. Investigation of Landslides, causes and mitigation. Major geological hazards Geological considerations in design of constructed facilities and infrastructure.

List of Exercises

- Identification of type of rock
- Identification of type of mineral
- Geophysical exploration
- Fly levelling and economic section for a road

TOTAL: 45 +15 Hours

TEXT BOOKS:

- T1: Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012A text book of waves and oscillations, BrijLal and N. Subrahmanyam, Vikas Publishing, New Delhi.
- T2: Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt,
- T3: Parbin Singh. A "Text book of Engineering and General Geology", Katson publishing house, Ludhiana 2009.
- T4: Chenna Kesavulu N. "Textbook of Engineering Geology", Macmillan India Ltd., 2009
- T5: Gokhale KVGK, "Principles of Engineering Geology", B.S. Publications, Hyderabad 2011.

REFERENCE BOOKS:

- R1: Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010
- R2: Bell .F.G. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
- R3: Dobrin, M.B "An introduction to geophysical prospecting", McGraw Hill, New Delhi, 1988.

WEB LINKS:

1. <https://nptel.ac.in/courses/105105106>
2. <https://nptel.ac.in/courses/105104191>
3. https://onlinecourses.swayam2.ac.in/cec19_mm02/preview

COURSE OUTCOMES

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

CO 1	Understand the physical geology of the earth and analyse its scope, relevance in civil engineering	K2
CO 2	Identify the different minerals based on their property	K2
CO 3	Associate the use of different kinds, distribution of rocks based on their property and their uses in civil engineering	K2
CO 4	Understand the different geological structures and to identify and choose the various geophysical investigations	K2
CO 5	Understand and identify the Geological conditions necessary for design and construction of large infrastructure	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS O 1	PS O 2
C01	2	1	1	1	1	3	2	1	2	3	-	3	2	2
C02	2	1	1	2	1	3	2	1	2	3	-	3	2	1
C03	2	1	2	2	1	3	2	1	2	3	-	3	2	1
C04	2	2	3	3	3	3	2	3	3	3	3	3	3	3
C05	2	2	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.0	1.4	2.0	2.2	1.8	3.0	2.2	1.8	2.4	3.0	3.0	3.0	2.4	2.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
✓			✓	✓	

22CMV047	COMPUTER AIDED CIVIL ENGINEERING DRAWING	L	T	P	Credits
	LABORATORY	0	0	2	1

COURSE OBJECTIVES:

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

- To introduce drafting 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.
- To get knowledge about Computer Aided Drawing software.

LIST OF EXERCISES

1. Drawing of a plan, elevation and cross section for Fully Paneled Door
2. Drawing of a plan, elevation and cross section for Glazed and Paneled door
3. Drawing of a plan, elevation and cross section for Fully Paneled window
4. Drawing of a plan, elevation and cross section for Glazed and Paneled window
5. Drawing of a plan, elevation and cross section for different types of Brick Bonds
6. Drawing of a plan, elevation and cross section for different types of Stair Case
7. Drawing of a Roof Truss – King Post
8. Drawing of a Roof Truss – Queen Post
9. Drawing of a Steel Simple Roof Truss
10. Drawing of a plan, elevation and cross section for Residential Building – I
11. Drawing of a plan, elevation and cross section for Residential Building – II
12. Drawing of a plan, elevation and cross section for Office Building

TOTAL: 30 hours

TEXT BOOKS:

T1: Dhananjay A.Jolhe, "Engineering Drawing with an Introduction to AutoCAD", Tata McGraw Hill Publishing Company Limited, 1st Edition, 2008.

REFERENCE BOOKS:

R1: Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Building Construction", Laxmi publications Pvt. Ltd., 10th Edition, Latest reprint 2014.

COURSE OUTCOMES:

CO 1	Draw the plan, section and elevation of a door and window	K3
CO 2	Create, analyze and produce 2D drawings of buildings in AUTO CAD environment	K6
CO 3	Develop knowledge on drawing of different trusses	K3

CO 4	Model the different components of a building	K6
CO 5	Model a drawing plan, an elevation and a cross-section of residential buildings	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PS01	PS02
C01	2	3	3	2	3	1	-	1	2	3	-	3	2	1
C02	3	3	3	2	3	2	-	1	2	3	-	3	2	1
C03	3	3	2	2	3	1	-	-	2	1	-	3	3	1
C04	3	3	3	2	3	2	-	1	2	3	-	3	2	2
C05	3	3	3	2	3	2	-	1	2	3	-	3	3	2
Average	2.8	3.0	2.8	2.0	3.0	1.6	-	1.0	2.0	2.6	-	3.0	2.4	1.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓		✓	✓	✓

		L	T	P	Credits
22CMV048	MODERN SURVEYING LABORATORY	0	0	2	1

COURSE OBJECTIVES:

- To familiarize with the various surveying instruments like Chain, Plane Table, Dumpy level, Theodolite and Total Station
- To know about the various techniques of chaining, leveling, traversing, contouring etc... and its practical applications in the field of civil engineering

LIST OF EXPERIMENTS

1. Chain Traversing
2. Compass Traversing
3. Fly leveling using Dumpy level & Check leveling
4. Measurement of horizontal angles and vertical angles by reiteration method
5. Measurement of horizontal angles and vertical angles by repetition method
6. Theodolite survey traverse
7. Heights and distances - Triangulation - Single plane method.
8. Setting out works - Foundation marking
9. Setting out works - Simple curve (right/left-handed) - Transition curve.
10. Field observation for and Calculation of azimuth
11. Field work using Total Station.
12. Longitudinal Section (LS) and Cross Section (CS)

TOTAL: 30 Hours

TEXT BOOKS:

- T1: T.P. Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.
- T2: Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005.
- T3: S.S.Bhavikatti, Surveying Theory and Practice, I.K.International Publishing House Pvt. Ltd, New Delhi, 2010.
- T4: Satheesh Gopi, rasathishkumar, Nmadhu, “ Advanced Surveying , Total Station GPS and Remote Sensing “ Pearson education , 2007

REFERENCE BOOKS:

- R1: Kanetkar T.P., “Surveying and Leveling”, Vols. I and II, United Book Corporation, Pune, 2010.
- R2: Punmia B.C.,”Surveying”, Vols. I, Laxmi Publications, 16th Edition, 2005
- R3: Clark D., “Plane and Geodetic Surveying”, Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition, 2001.

COURSE OUTCOMES

CO 1	Conduct survey and gather field data	K3
CO 2	Develop field notes from survey data	K3
CO 3	Infer from survey data and compute areas and volumes	K3
CO 4	Setting out a curve by applying the principles of surveying	K6
CO 5	Determine the LS and CS of a road	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P O 11	PO 12	PSO 1	PSO 2
C01	2	3	3	2	3	1	-	1	2	3	-	3	2	1
C02	3	3	2	2	3	2	-	1	2	3	-	3	2	1
C03	3	3	2	2	3	1	-	-	2	3	-	3	3	1
C04	3	3	3	2	3	2	-	1	2	3	-	3	2	2
C05	3	3	3	2	3	2	-	1	2	3	-	3	3	2
Average	2.8	3.0	2.6	2.0	3.0	1.6	-	1.0	2.0	3.0	-	3.0	2.4	1.4

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓		✓	✓	✓

COURSE OBJECTIVES:

- To improve leadership quality by understanding the various etiquettes.
- To inculcate the need to continuously develop analytical and logical skills.

UNIT I SOFT SKILLS III 6

Basic Etiquette – Email etiquette – Business etiquette – Telephone etiquette – Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development

UNIT II QUANTITATIVE APTITUDE I 6

Percentage – Profit Loss –Discount – Ratio Proportion – Time & Work – Time, Speed & Distance. Problems relating to ages– Permutation & Combination–Probability

UNIT III QUANTITATIVE APTITUDE II 6

Mensuration – Clocks and Calendars – Boats – Simple Interest – Compound Interest – Fractions and Decimals – Square roots – Functions.

UNIT IV ANALYTICAL PROBLEMS 6

Introduction – Linear Sequencing – Seating Arrangements – Distribution/Double Line Up – Selection – Ordering and Sequencing – Binary Logic – Venn Diagrams –Directions.

UNIT V LOGICAL PROBLEMS 6

Introduction to Logical problems – Cause and Effect – Course of Action – Statement and Assumption – Letter and Symbol series – Analogies.

TOTAL: 45Hours

TEXT BOOKS:

- T1. K. R. Dhanalakshmi and N S Raghunathan, Personality Enrichment, Margham Publications, 2012
 T2. R. S. Agarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publishers, 2017

REFERENCE BOOKS:

- R1. D. P. Sabharwal, Personality Development Handbook, Fingerprint publishing, 2021
 R2. A.K Gupta, Logical and Analytical Reasoning (English), Ramesh Publishing House, 2022

WEBLINKS:

1. <https://www.talentlyft.com/en/resources/what-is-aptitude-and-ability-tests>
2. <https://www.zippia.com/advice/logical-thinking-skills/>
3. <https://www.cleverism.com/skills-and-tools/logical-thinking/>

COURSE OUTCOMES

C01:	Discuss the basic, email, business, telephone and meeting etiquettes.	K2
C02:	Solve problems on ratio proportion related to profit and loss, discounts, time and work, Time, speed and distance.	K3
C03:	Work with fractions, decimals and square roots.	K3
C04:	Analyze the cause, effect and course of action in logical problems.	K4
C05:	Solve problems on the letter and symbol series.	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O 1	PS O 2
C01	-	-	-	-	-	-	-	-	2	2	-	3	2	-
C02	3	2	2	1	1	-	-	-	3	1	-	3	2	-
C03	3	2	1	1	1	-	-	-	2	2	-	3	2	-
C04	3	2	1	1	1	-	-	-	2	2	-	3	2	-
C05	3	3	1	1	1	-	-	-	2	2	-	3	2	-
Average	3.0	2.3	1.3	1.0	1.0	-	-	-	2.2	1.8	-	3.0	2.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓	✓	✓	✓	✓	

COURSE OBJECTIVES

At the end of this course the student is expected

- To understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future
- To provide understanding of component of environment, their function ,quality, issues related to environment ,effect of quality degradation on human beings and their solutions

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**9**

Definition – Scope and importance – Need for public awareness – Concepts 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 – Bio-geographical 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 and Birds.

Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION**9**

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**9**

Forest resources -Use and over – Exploitation – Deforestation – Case studies – Timber extraction –Mining – Dams and their 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 9

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 9

Population Growth, Variation among Nations – Population Explosion Family Welfare Programme – environment and Human Health – Human Rights –Value Education – HIV /AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health – Case Studies.

TOTAL: 45 Hours

TEXT BOOKS

T1: Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).

T2: Benny Joseph, 'Environmental Science and Engineering', Tata McGraw- Hill, New Delhi, (2006).

REFERENCE BOOKS

R1: R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol.I and II, Enviro Media.

R2: Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.

R3: Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.

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

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc20_ge16/preview
2. <https://ggn.dronacharya.info/APSDept/Downloads/QuestionBank/ENVIRONMENTAL-STUDIES/NPTEL-Link.pdf>
3. <http://eagri.org/eagri50/ENVS302/pdf/lec14.pdf>
4. https://onlinecourses.nptel.ac.in/noc19_ge22/preview

COURSE OUTCOMES

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

CO 1	Understand the core concepts, methods of ecological and physical sciences, their application in environmental problem-solving	K2
CO 2	Apply system concepts and methodologies to analyse, understand the interactions between social and environmental processes	K3
CO 3	Apply the ethical, cross-cultural, and historical context of environmental issues and the link between human and natural systems	K3
CO 4	Develop the understanding based on the observations and illustration, drawn from the experiences of physical, biological, social and cultural aspects of life, rather than abstractions	K3
CO 5	Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	1	1	-	-	-	-	-	1	1	1	-	1	2	-
C02	1	1	-	-	-	-	-	1	1	1	-	-	-	-
C03	-	1	-	-	-	-	-	2	-	1	-	1	-	-
C04	-	-	-	-	-	-	-	-	-	1	-	-	-	2
C05	1	-	-	1	-	-	-	2	1	1	-	1	-	-
Average	1.0	1.0	-	1.0	-	-	-	1.5	1.0	1.0	-	1.0	2.0	2.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓	✓		✓		

22MCMC41	GENDER INSTITUTION AND SOCIETY	L	T	P	Credits
		2	0	0	2

COURSE OBJECTIVES:

- The course helps the student to understand concepts of social justice and gender justice. It provides the student with the knowledge of various institutions functioning worldwide which aim to eradicate discrimination against women.
- The course further aids students in understanding feminism and gender in relation to the society and to study the basic constitutional remedies available to women.

UNIT – I JUSTICE 6

Social Justice and Gender Justice – Theories relating to Social Justice – Theories relating to Gender Justice – Interrelationship between Gender justice and Social Justice

UNIT – II WOMEN PROTECTION 6

International Conventions for protection of Women – Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) – National Commission for women – Constitutional remedies available for women under Indian Constitution.

UNIT – III WOMEN ASSOCIATION 6

United Nations Entity for Gender Equality and the Empowerment of Women (UN Women) - Association for Women's Rights in Development (AWID) – Women kind worldwide – Centre for reproductive rights - Women's Environment and Development Organization (WEDO) - Global Fund for Women

UNIT – IV GENDER RESEARCH & EQUALITY 6

International Center for Research on Women (ICRW) - European Institute for Gender Equality (EIGE) – Promundo - International Alliance of Women (IAW) - International Women's Development Agency (IWDA).

UNIT – V FEMINISM 6

World Health organisation – Sex and Gender – Feminism – Theories relating to Feminism – Gender and society

Total: 30 Hours

TEXT BOOKS

- T1: Law relating to Women and children, Mamta Rao
- T2: Gender, Politics and Institutions: Towards a Feminist Institutionalism, by Mona Lena Krook and Fiano Mackay, 2010
- T3: Gender Justice and Feminist Jurisprudence, Dr. Sheetal Kanwal, 2015
- T4: Narain's Gender and society, P. Jain

REFERENCE BOOKS

R1: Gender Justice and feminist Jurisprudence by Dr.Ishitha Chatterjee

R2: Gender and Institutions, Moira Gatens and Alison Mackinnon

SUGGESTED READINGS:

1. Women and Gender : Society and Community , Siddhartha Sarkar

COURSE OUTCOMES:

After the completion of this Course, the student would be able to:

C01:	Understand the Concept of Social Justice and Gender Justice.	K2
C02:	Learning the International Conventions and constitutional remedies available for women.	K2
C03:	Identify the various gender Institutions and its functions for the development of women	K2
C04:	Assessing the International agencies.	K3
C05:	Summarizing the study on feminism and relation of gender and society.	K3

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	-	-	-	-	-	3	2	2	-	-	-	2	3	-
C02	-	-	-	-	-	3	2	2	-	-	-	3	3	-
C03	-	-	-	-	-	3	2	2	1	-	-	3	3	-
C04	-	-	-	-	-	3	2	2	1	-	-	3	3	-
C05	-	-	-	-	-	3	3	2	1	-	-	3	3	-
Average	-	-	-	-	-	3.0	2.2	2.0	1.0	-	-	2.8	3.0	-

ASSESSMENT METHOD

CAT1	CAT2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/Presentation	Open book test
			✓		

22CMC051	GEOTECHNICAL ENGINEERING	L	T	P	Credits
		3	1	0	4

COURSE OBJECTIVES

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

- To specify a strategy for site investigation to identify the soil deposits and determine the depth and spatial extent within the ground;
- Understand various site investigation techniques and their in-situ applications;
- Prepare a soil investigation report based on borehole log data and various in-situ tests like SPT, CPT etc.,

UNIT I INTRODUCTION & PLASTICITY CHARACTERISTICS OF SOIL 12

Origin, Nature and type of Soils, its formation and deposition – Phase system in terms of weight, volume, void ratio and porosity-Basic Definition and Relationship – Sieve analysis - Sedimentation Analysis – Determination of various parameters: Moisture content, Unit Weight, Specific Gravity, Consistency limits and Indices– Soil Classification for Engineering purposes – Particle size Classification, Textural classification, Unified soil Classification and Indian Standard Classification System – Field Identification of soils- Clay Minerals

UNIT II PERMEABILITY AND EFFECTIVE STRESS PRINCIPLES 12

Soil water – Various forms – Influence of clay minerals – Capillary rise – Suction - Effective stress concepts in soil – Total, Neutral and Effective stress distribution in soil in effect of Water table - Permeability – Darcy's Law, Permeability measurement in the laboratory and Field methods- Factors affecting permeability – Quick sand condition – Seepage Analysis – Laplace Equation - Introduction to flow nets – Properties and uses - Application to simple problems.

UNIT III STRESS DISTRIBUTION & COMPACTION 12

Stress distribution in soil media – Boussinesq's formula – stress due to point load, line load and strip load, uniformly loaded circular and rectangular loaded area – Newmark's Influence charts – Westergaard equation for point load- Contact pressure under rigid and flexible area – Theory of compaction- Laboratory Determination of Optimum moisture content and maximum dry density- Factors affecting compaction

UNIT IV SHEAR STRENGTH & CONSOLIDATION 12

Introduction on Consolidation- Comparison of Compaction and Consolidation- Components of settlement- Immediate and consolidation settlement - Terzaghi's one dimensional consolidation theory – governing differential equation - laboratory consolidation test- Shear strength of cohesive and cohesionless soils - Mohr - Coulomb failure theory – Saturated soil - Strength parameters - Measurement of shear strength, direct shear, Triaxial compression, UCC and Vane shear tests –Types of shear tests based on drainage and their applicability - Drained and undrained behaviour of clay and sand

UNIT V SLOPE STABILITY**12**

Types of Slopes and Slope failure mechanisms- Analysis of Finite and Infinite Slopes - Swedish Circle Method- Friction circle method - stability number – problems – Slope protection measures

TOTAL: 60 hours**TEXT BOOKS:**

T1: Punmia P.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., 16th Edition, New Delhi, 2005.

T2: Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2010.

Reference books:

R1: McCarthy D.F., "Essentials of Soil Mechanics and Foundations Basic Geotechniques", Sixth Edition, Prentice-Hall, New Jersey, 2002.

R2: Das, B.M, "Principles of Geotechnical Engineering", (fifth edition), Thomas Books, 2005

R3: Muni Budhu, "Soil Mechanics and Foundations", John Willey & Sons, Inc, New York, 2008.

WEB LINKS:

1. <https://nptel.ac.in/courses/105105168>

2. <https://nptel.ac.in/courses/105103207>

COURSE OUTCOMES

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

CO 1	Understand the site soil condition by classifying and identifying the index properties of soil	K2
CO 2	Determine and calculate the effective permeability and plot stress distribution diagram of soil mass	K3
CO 3	Determine the comparative effort and compute the vertical stress in a semi-infinite soil mass	K3
CO 4	Evaluate ground settlements against time and stiffness of soil using shear strength parameters	K5
CO 5	Evaluate factor of safety of infinite slopes and to prepare a soil investigation based on borehole log data	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	2	1	2	2	-	-	-	-	-	-	-	3	-	2
C02	2	2	2	2	-	-	-	-	-	-	-	3	-	2
C03	3	2	3	3	-	-	-	-	-	-	-	3	2	3
C04	3	3	3	3	-	-	-	-	-	-	-	3	2	3
C05	3	2	3	3	-	-	-	-	-	-	-	3	2	3
Average	2.6	2.0	2.6	2.6	-	-	-	-	-	-	-	3.0	2.0	2.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Study
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
			✓	✓	

22CMC052	STRUCTURAL ANALYSIS	L	T	P	Credits
		3	1	0	4

COURSE OBJECTIVES

- Analyze the structure / frame for various scenarios
- Understand various different analysis methods

UNIT I SLOPE DEFLECTION METHOD 12

Slope deflection equations- Analysis of continuous beams and Analysis of rigid frames with sway and Analysis of rigid frames without sway - Symmetry of rigid frames and anti symmetry of rigid frames – Simplification for hinged end - Support settlements of rigid frames.

UNIT II MOMENT DISTRIBUTION METHOD 12

Stiffness and carry over factors – Distribution and carryover of bending moments - Analysis of continuous Beams by moment distribution method - Analysis of rigid frames with sway by moment distribution method - Analysis of rigid frames without sway by moment distribution method - Plane rigid frames with and without sway.

UNIT III MOVING LOADS AND INFLUENCE LINES 12

Influence lines for reactions in statically determinate structures – influence lines for member forces in pin jointed frames – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads. Rolling loads – Influence line diagram - Influence lines for reactions- Influence lines for shear force and bending moment - Muller Breslau's principle – Application of Muller Breslau's principle to determinate beams and Application of Muller Breslau's principle continuous beams.

UNIT IV ARCHES 12

Arches structural forms – Examples of arch structures – Types of arches – Analysis of three hinged parabolic arch- for various loads, Analysis of three hinged circular arch for various loads, Analysis of two hinged parabolic arches for various load conditions and Analysis of two hinged circular arches for various load conditions , fixed arches parabolic and circular arches – Settlement and temperature effects

UNIT V SUSPENSION BRIDGES AND SPACE TRUSSES 12

Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders. Introduction to analysis of space trusses using method of tension coefficients – Beams curved in plan.

TOTAL: 60 Hours

TEXT BOOKS:

T1: Vaidyanathan.R, Perumal.P, "Structural Analysis-I,II", Laxmi Publications, Fourth Edition,2008

T2: Bhavikatti, S S., "Structural Analysis", Vol.1 and 2, Vikas Publishing House Pvt Ltd., New Delhi-4, 2011.

T3: B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, "Theory of structures", Laxmi Publications, New Delhi, 12th Edition, 2004.

REFERENCE BOOKS:

R1: William Weaver, Jr & James M. Gere, "Matrix analysis of framed structures", CBS Publishers & Distributors, Delhi, 2005

R2: Ashok K. Jain, "Advanced Structural Analysis", Nem Chand & Sons, 2008

R3: Vaidyanathan. R, Perumal. P, "Structural Analysis-I", Laxmi publications, Fourth edition, 2008

R4: Pandit G.S. and Gupta S.P., "Structural Analysis – A Matrix Approach", Tata McGraw Hill Publishing Company Ltd., 2008.

WEBLINK:

1. <https://nptel.ac.in/courses/105105166>
2. <https://nptel.ac.in/courses/105101085>

COURSE OUTCOME:

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

CO 1	Sketch the influence line for shear force, bending moment and member forces in statically indeterminate structure	K3
CO 2	Analyze the different types of Arches	K4
CO 3	Analyze the suspension bridges	K4
CO 4	Analyze the continuous beam and frame structure by slope deflection method	K4
CO 5	Analyze the continuous beam and frame structure by moment distribution method	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	2	2	2	1	-	-	-	-	2	-	3	3	1
CO2	2	2	2	2	1	-	-	-	-	2	-	3	3	1
CO3	3	2	3	3	1	-	-	-	-	2	-	3	3	1
CO4	3	3	3	3	1	-	-	-	-	2	-	3	3	1
CO5	3	3	3	3	1	-	-	-	-	2	-	3	3	1
Average	2.6	2.4	2.6	2.6	1	-	-	-	-	2	-	3	3	1

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
✓	✓			✓	

		L	T	P	Credits
22CMC053	CONSTRUCTION ENGINEERING & MANAGEMENT	3	1	0	4

COURSE OBJECTIVES:

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

- To ability to plan, control and monitor construction projects.
- To understand the logic behind the network diagram.
- To understand the important of construction Management

UNIT I INTRODUCTION 5

Basics of Construction- Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution.

UNIT II MANAGEMENT TECHNIQUES 12

Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

UNIT III CONSTRUCTION METHODS 9

Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

UNIT IV CONSTRUCTION EQUIPMENT 9

Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities- Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site

UNIT V CONTRACTS MANAGEMENT**9**

Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to precede, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination

List of Exercises

1. Draw a Bar Chart and Gantt Chart for an activity and state the inference of the comparison
2. Create a work break-down structure for construction of foundation
3. Create a work break-down structure for construction of roof
4. Evaluate the total duration of an activity using CPM
5. Determine the shortest time for an activity using PERT
6. Determine slack, float and earliest time of completion using PERT analysis

TOTAL: 45+15 hours**TEXT BOOKS:**

- T1: Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
T2: National Building Code, Bureau of Indian Standards, New Delhi, 2017.
T3: Chudley, R., "Construction Technology", ELBS Publishers, 2007.
T4: Peurifoy, R.L. "Construction Planning, Methods and Equipment", McGraw Hill, 2011

REFERENCE BOOKS:

- R1: Nunnally, S.W. "Construction Methods and Management", Prentice Hall, 2006
R2: Jha, Kumar Neeraj., "Construction Project management, Theory & Practice", Pearson Education India, 2015
R3: Punmia, B.C., Khandelwal, K.K., "Project Planning with PERT and CPM", Laxmi Publications, 2016.

WEBLINKS:

1. <https://nptel.ac.in/courses/105104161>
2. <https://nptel.ac.in/courses/105103093>
3. <https://nptel.ac.in/courses/105102088>

COURSE OUTCOMES:

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

CO 1	Compare the different types of chart and select the optimum one	K3
CO 2	Develop the scheduling activity path for a construction using PERT	K6
CO 3	Understand the different construction methods by comparing their merits	K2
CO 4	Make use of the various construction equipment for varying construction operations	K3

CO 5	Relate to the knowledge on contracts to find the performance parameters of a contract	K2
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MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	2	2	2	2	1	-	-	-	-	2	3	3	3	3
C02	2	2	2	2	1	-	-	-	-	2	3	3	3	3
C03	2	1	-	1	-	1	1	-	-	1	2	3	2	1
C04	2	-	-	1	-	1	1	-	-	-	2	3	2	1
C05	3	3	3	3	1	-	-	-	-	2	2	3	2	2
Average	2.2	2.0	2.4	1.8	1.0	1.0	1.0	-	-	1.8	2.4	3.0	2.4	2.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Record	Viva	Projects	Seminars	Demonstration / Presentation	Open Book Test
✓	✓			✓	

COURSE OBJECTIVES

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

- To impart knowledge on behavior and the performance of saturated and unsaturated soil.
- To attain adequate knowledge in assessing both physical and engineering behavior of soils through various experiments

LIST OF EXPERIMENTS

1. Grain size distribution - Sieve analysis
2. Grain size distribution - Hydrometer analysis
3. Specific gravity of soil grains
4. Relative density of sands
5. Atterberg limits test
6. Determination of moisture - density relationship using Standard Proctor test.
7. Permeability determination (constant head and falling head methods)
8. Field density test (Core cutter and sand replacement methods)
9. Direct shear test on cohesion less soil
10. Unconfined compression test on cohesive soil
11. California Bearing Ratio Test
12. One dimensional consolidation test (Demonstration only)

Total: 30 Hours

TEXT BOOKS:

- T1: Punmia P.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., 16th Edition, New Delhi, 2005.
- T2: Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2010.

REFERENCE BOOKS:

- R1: McCarthy D.F., "Essentials of Soil Mechanics and Foundations Basic Geotechniques", Sixth Edition, Prentice-Hall, New Jersey, 2002.
- R2: Das, B.M., "Principles of Geotechnical Engineering", (fifth edition), Thomas Books, 2005
- R3: Muni Budhu, "Soil Mechanics and Foundations", John Willey & Sons, Inc, New York, 2008.

COURSE OUTCOMES

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

CO 1	Determine index properties of soils	K4
CO 2	Classify soils based on experimental results	K3

CO 3	Understand and experience experimental measurement of the physical and mechanical soil properties commonly used in engineering practice	K2
CO 4	Design and conduct appropriate experiments, as well as to analyze and interpret data and generate soil report	K6
CO 5	Gain knowledge about appropriate experiments based on field conditions	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P 04	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PS01	PS02
C01	2	3	2	3	3	-	-	-	3	2	3	-	3	2
C02	2	3	-	2	2	-	-	-	3	2	3	-	3	3
C03	2	3	3	3	3	-	-	-	3	2	3	-	3	2
C04	2	3	-	3	3	-	-	-	3	2	3	-	3	3
C05	2	3	3	3	3	-	-	-	3	2	3	-	3	2
Average	2.0	3.0	2.0	2.8	2.8	-	-	-	3.0	2.0	3.0	-	3.0	2.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓			✓	✓

22CMC055	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	Credits
		0	0	2	1

COURSE OBJECTIVES

- This subject includes the list of experiments to be conducted for characterization of water and municipal sewage
- At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

Any Eight Experiments

1. Sampling and preservation methods of water and wastewater
2. Determination of pH, Turbidity and Hardness
3. Determination of iron & fluoride
4. Determination of residual chlorine
5. Determination of Chlorides
6. Determination of Ammonia Nitrogen
7. Determination of Sulphate
8. Determination of Optimum Coagulant Dosage
9. Determination of available Chlorine in Bleaching powder
10. Determination of dissolved oxygen
11. Determination of suspended, volatile and fixed solids
12. B.O.D. test
13. C.O.D. test
14. Introduction to Bacteriological Analysis (Demonstration only)

TEXT BOOKS:

- T1: Garg, S.K., "Environmental Engineering", Vol.1 Khanna Publishers, New Delhi, 2011.
- T2: Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications (P) Ltd., New Delhi, 13th Edition, 2015.

REFERENCE BOOKS:

- R1: Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2003.

WEB LINKS:

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/index.html

COURSE OUTCOMES

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

CO 1	Understand the sampling and preservation methods of water and wastewater	K2
CO 2	Analyze physical and chemical parameters of water and waste water	K4
CO 3	Understand the criteria for determination of Physical characteristics of water and wastewater	K2
CO 4	Acquire knowledge on influence of chlorides and chlorine on water quality	K3
CO5	Acquire knowledge on DO, BOD and COD influence on water and wastewater	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
CO1	2	1	1	3	1	3	3	3	3	3	-	3	3	-
CO2	2	1	1	3	1	3	3	3	3	3	-	3	3	-
CO3	2	1	1	3	1	3	3	3	3	3	-	3	3	-
CO4	2	1	1	3	1	3	3	3	3	3	-	3	3	-
CO5	2	1	1	3	1	3	3	3	3	3	-	3	3	-
Average	2.0	1.0	1.0	3.0	1.0	3.0	3.0	3.0	3.0	3.0	-	3.0	3.0	-

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓			✓	✓

COURSE OBJECTIVE:

- To enhance the communication, interpersonal, group skills.

UNIT I	VERBAL APPTITUDE I	6
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Phonetics / Neutral Accent / Pronunciation – Speech Mechanism / Mouth & Face Exercise – Vowels & Consonants – Sounds – Syllable and Syllable Stress/ Word Stress – Sentence Stress & Intonation Articulation Exercise – Rate of Speech / Flow of Speech / Idiomatic Phrases.

UNIT II	VERBAL APTITUDE II	6
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Singular/plural – present tense / past tense – genders Prepositions – conjunctions – Choice of words – simple sentences – compound sentences – summarizing phrases Synonyms – Antonyms – Analogies – Similar Words.

UNIT III	SOFT SKILLS	6
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Attitude – Meaning–Features of attitude – Formation – Personality Factors –Types of attitude – change in attitude – developing Positive attitude.

UNIT IV	TIME MANAGEMENT	6
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Definition – Meaning–Importance, Value of time as an important resource – comparison of Time and Money – Circle of influence and circle of control – Definition of URGENT and IMPORTANT – Time Wasters and how to reduce – Procrastination – meaning and impact – 4 Quadrants.

UNIT V	TEAM BUILDING	6
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Meaning – Aspects of team building – Process of team building – Types of Teams – Team Ethics and Understanding – Team trust and commitment.

TOTAL: 30 Hours

TEXT BOOKS:

- T1. B N Ghosh, Managing Soft Skills and Personality, Mc graw Hill Publications
- T2. Shejwalkar and Ghanekar, Principles and Practices of Management, Mc Graw Hill Latest.
- T3. Roberta Roesch ,Time management for Busy people, Tata McGraw–Hill Edition

REFERENCE BOOKS:

- R1. D. P. Sabharwal, Personality Development Handbook, Fingerprint publishing, 2021
- R2. Dr V M Selvaraj, Personality Development, Bhavani Publications

WEBLINKS:

1. <https://www.thebalancecareers.com/list-of-soft-skills-2063770>
2. <https://www.investopedia.com/terms/s/soft-skills.asp>
3. <https://in.indeed.com/career-advice/resumes-cover-letters/soft-skills>

COURSE OUTCOMES

C01:	Articulate by understanding the rate and flow of speech.	K3
C02:	Choose words and phrases appropriately for any verbal communication.	K3
C03:	Develop a positive attitude in handling diverse situations.	K4
C04:	Prioritize important and urgent tasks using the four quadrants method.	K4
C05:	Practice team ethics and understanding when working with teams.	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
C01	-	-	-	-	-	-	-	-	3	3	-	3	3	-
C02	-	-	-	-	-	-	-	-	3	3	-	3	2	-
C03	-	-	-	-	-	-	-	-	3	3	-	3	3	-
C04	-	-	-	-	-	-	-	-	3	3	-	3	2	-
C05	-	-	-	-	-	-	-	3	3	3	-	3	2	-
Average	-	-	-	-	-	-	-	3.0	3.0	3.0	-	3.0	2.4	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test

22CMC061	DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- To enable the designer to learn the design of these basic reinforced concrete elements.
- To gain knowledge on the basic structural elements like beams, columns, slabs, walls and foundations

UNIT I INTRODUCTION 9

Objective of structural design-Steps in RCC Structural Design Process- Type of Loads on Structures and Load combinations- Code of practices and Specifications - Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC – Properties of Concrete and Reinforcing Steel - Analysis and Design of Singly reinforced Rectangular beams by Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods - Analysis and design of singly and doubly reinforced rectangular beams by Limit State Method.

UNIT II DESIGN OF BEAMS 9

Analysis and design of Flanged beams for – Use of design aids for Flexure - Behaviour of RC members in Shear, Bond and Anchorage - Design requirements as per current code - Behaviour of rectangular RC beams in shear and torsion - Design of RC members for combined Bending, Shear and Torsion.

UNIT III DESIGN OF SLABS AND STAIRCASE 9

Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams- Two way slab- Design of simply supported and continuous slabs using IS code coefficients- Types of Staircases – Design of dog-legged Staircase.

UNIT IV DESIGN OF COLUMNS AND FOOTINGS 9

Types of columns –Axially Loaded columns – Design of short Rectangular, Square and circular columns Design of Slender columns- Design for Uniaxial and Biaxial bending using Column Curves. Concepts of Proportioning footings and foundations based on soil properties-Design of wall footing – Design of axially and eccentrically loaded Square, Rectangular pad and sloped footings – Design of Combined Rectangular footing for two columns only

UNIT V INTRODUCTION TO PRESTRESSED CONCRETE 9

Basic concepts – Advantages and disadvantages – Materials required – Systems and methods of pre-stressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long-term deflections - Losses of pre-stress – Estimation of crack width.

TOTAL: 45 hours

TEXT BOOKS:

- T1: Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2017..
- T2: Gambhir. M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2016.
- T3: Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw- Hill Publishing Company Ltd., New Delhi

REFERENCE BOOKS:

- R1: Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi, 3rd Edition, 2008.
- R2: Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Limit State Design of Reinforced Concrete", Laxmi Publishing Pvt. Ltd., First Edition, New Delhi, 2007
- R3: Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Roorkee
- R4: Sinha, S.N., "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi.
- R5: SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 2016
- R6: IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2016

WEB LINKS:

1. <https://nptel.ac.in/courses/115102117>
2. <https://nptel.ac.in/courses/108106193>
3. <https://nptel.ac.in/courses/122106074>

COURSE OUTCOMES

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

CO 1	Classify the various design methodologies and code of practices for RCC design	K3
CO 2	Know the analysis and design of slabs and staircases under various conditions	K2
CO 3	Design the various types of beams in flexural conditions	K4
CO 4	Construct the design philosophy for different compression members and RC footings by using limit state method	K3
CO 5	Calculate the effective stresses and deflection in pre-stressed concrete structures	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	2	-	-	-	-	-	-	-	1	-	-	-	3	-
C02	3	-	-	-	-	-	-	-	2	-	-	2	3	-
C03	3	-	-	-	-	-	-	-	2	-	-	2	3	-
C04	3	-	-	-	-	-	-	-	2	-	-	2	3	-
C05	3	-	-	-	-	-	-	-	2	-	-	2	3	-
Average	2.8	-	-	-	-	-	-	-	1.8	-	-	2.0	3.0	-

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓	✓		✓	✓

22CMC062	CONCRETE TECHNOLOGY	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES:

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

- To impart knowledge to the students on the properties of materials for concrete by suitable tests, mix design for concrete and special concretes.

UNIT I	INTRODUCTION TO CONCRETE	9
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Concrete; Properties of ingredients, tests, Production of concrete, mixing, compaction curing, Properties of fresh concrete, workability tests for fresh concrete, strength properties of hardened concrete: compressive strength, split tensile strength, flexural strength.

UNIT II CONCRETE MIX DESIGN 9

Concrete mix design: Design mix and Nominal mix. Proportioning of concrete mixes, basic considerations, cost, specifications, factors in the choice of mix proportion, different method of mix design (IS method; ACI method)

UNIT III CONCRETE CREEP, SHRINKAGE FATIGUE 9

Stress-strain curve for concrete, modulus of elasticity, Time dependent behavior of concrete -creep, shrinkage and fatigue; Concrete cracking, types of cracks, causes and remedies. Defects in Concrete, Non-destructive tests on concrete.

UNIT IV DURABILITY OF CONCRETE 9

Quality control, Behavior of concrete in extreme environment; temperature problem in concreting, hot weather, cold weather and under water conditions, Resistance to freezing, sulphate and acid attack, efflorescence, fire resistance; Inspection and testing of concrete, Deterioration of concrete and its prevention Repair and rehabilitation.

UNIT V SPECIAL CONCRETE 9

Special concrete: light Weight concrete, foam concrete, self compacting concrete, Fibre reinforced concrete, vacuum concrete, high strength concrete, ferrocement, Ready mix concrete, SIFCON, Shotcrete, High Performance concrete Polymer concrete, chemical admixtures: accelerators, retarders, plasticizers, super plasticizers, mineral admixtures: fly ash, silica fume, GGBFS, Metakaoline.

TOTAL: 45 hours

TEXT BOOKS:

1. Gupta.B.L,Amit Gupta,"concrete technology", Jain Book Agency,2010
2. Shetty.M.S,"Concrete technology",S.chand and company Ltd, New Delhi,2003.
3. Bhavikatti.S.S,"Concrete Technology", I.K International Housing Private Ltd, New Delhi, 2005.

4. Santhakumar.A.R, "Concrete Technology", Oxford University press India, 2006.
5. Varghese.P.C, "Maintenance, Repair and Rehabilitation & Minor works of buildings", Prentice Hall India Private Ltd. 2014.
6. Dodge Woodson R, "Concrete Structures, protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi, 2012.

REFERENCE BOOKS:

1. Gambhir.M.L, "Concrete Technology", Tata McGraw hill book Co.ltd., Delhi, 5th Edition, 2013.
2. Neville. A M., "Properties of Concrete", Longman, 5th Edition, 2011.
3. IS10262:2009 Recommended guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.
4. Job Thomas, "Concrete Technology", Cengage Learning Pvt.Ltd, Delhi, 2015.

WEBLINKS:

- <https://nptel.ac.in/courses/105102012>
- <https://www.digimat.in/nptel/courses/video/105106176/L01.html>

COURSE OUTCOMES:

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

CO 1	Identify the functional role of ingredients of concrete and apply this knowledge to mix design	K3
CO 2	Design a concrete mix as per IS standards	K3
CO 3	Apply fundamental knowledge in the fresh and hardened properties of concrete to identify the reasons for the cracks	K3
CO 4	Understand the durability requirements of concrete	K2
CO 5	Select the most suited special concrete depending on the site requirement	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	1	1	-	1	-	-	-	-	1	-	-	2	2	1
C02	2	3	3	2	-	-	-	-	2	3	1	2	3	3
C03	2	1	1	2	-	-	-	-	2	-	-	2	3	1
C04	1	3	-	1	-	2	3	-	2	-	1	2	3	2
C05	2	2	-	3	-	2	3	-	2	1	-	2	3	3
Average	1.6	2.0	2.0	1.8	-	2.0	3.0	-	1.8	2.0	1.0	2.0	2.8	2.0

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
	✓				✓

22CMC063	COMPUTER AIDED DESIGN AND DRAWING LABORATORY	L	T	P	Credits
		0	0	2	1

COURSE OBJECTIVES:

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

- To study the design and preparation of structural drawings for concrete / steel structures using AutoCad and STADD Pro normally encountered in Civil Engineering practice.

LIST OF EXERCISES

1. Drawing of a plan, elevation and cross section of a Residential Building for Corporation approval
2. Drawing of a plan, elevation and cross section for Industrial Structures
3. Design and Detailing of connection in Beam Column Joint
4. Design and Detailing of connection in Bracings with Gusset plate in Beam Column Joint
5. Design of RCC Slab (One Way) with detailing
6. Design of RCC Slab (Two Way) with detailing
7. Design and Detailing of RCC Rectangular Beams
8. Design and Detailing of RCC Tee Beam
9. Design of RCC Cantilever Beam using STADD Pro
10. Design of RCC Continuous Beam using STADD Pro
11. Analysis of Pin-jointed Truss using STADD Pro
12. Analysis of Framed Structure using STADD Pro

TOTAL: 30 hours

REFERENCE BOOKS:

- R1: Verma B.P., "Civil Engg. Drawing & House Planning", Khanna publishers, Delhi, 2010.
- R2: Balagopal & T.S. Prabhu, "Building drawing & detailing", Spades Publishers, Calicut.
- R3: Krishna Raju, "Structural Design & Drawing (Concrete & Steel)", CBS Publishers 2nd Edition, 2005
- R4: Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Design of steel structures", Lakshmi Publications Pvt. Ltd 2006.

COURSE OUTCOMES:

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

CO 1	Draw a plan, elevation and cross section of a residential building/industrial building for corporation approval	K6
CO 2	Develop a design template and detailing sheet for beam column joint and bracings in beam column joint	K6
CO 3	Design a two way slab or one way slab with detailing	K4
CO 4	Design and create a detailing drawing for different types of beams	K6
CO 5	Apply the knowledge of civil software to design various components of a framed structure	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	2	3	3	2	3	1	-	1	2	3	-	3	2	1
C02	3	3	3	2	3	2	-	1	2	3	-	3	2	1
C03	3	3	2	2	3	1	-	-	2	1	-	3	3	1
C04	3	3	3	2	3	2	-	1	2	3	-	3	2	2
C05	3	3	3	2	3	2	-	1	2	3	-	3	3	2
Average	2.8	3.0	2.8	2.0	3.0	1.6	-	1.0	2.0	2.6	-	3.0	2.4	1.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓		✓	✓	✓

COURSE OBJECTIVES

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

- To learn the basic behavior of fresh and hardened concrete through basic property tests, workability test, destructive and non-destructive test.
- To get hands on experience by conducting the tests and evolving inferences.

LIST OF EXPERIMENTS

1. Consistency test, Initial and final setting time of cement.
 - i. Specific gravity test on cement, fine aggregate and coarse aggregate.
 - ii. Sieve analysis test on coarse aggregate and fine aggregate.
 - iii. Determination of flakiness index, elongation index of coarse aggregate.
 - iv. Strength test on cement: compression, tension.
 - v. Workability test of fresh concrete (conventional): Slump cone test, Flow table test, Compaction factor test, Vee-Bee consistometer test.
 - vi. Workability test of fresh concrete (Self Compacting Concrete): Slump cone test, Flow table test, Compaction factor test, Vee-Bee consistometer test.
2. Strength test on hardened concrete (Conventional concrete): Compression, Tension, and Flexural.
3. Strength test on hardened concrete (Special concrete): Compression, Tension, and Flexural.
4. Durability test on (conventional and special concrete): Water penetration test, Rapid Chloride Penetration Test, Sorptivity test, Acid test.
5. NDT test on (conventional and special concrete): Re-bound hammer test, Ultrasonic pulse velocity test.
6. Mix Design of a particular grade of concrete
7. Practical study on different types of cracks and crack measurements in beams, columns of a building.

NOTE: Special Concrete may be any one of Fibre Reinforced Concrete, Self Compacting Concrete, High Strength Concrete, Polymer concrete.

TOTAL: 30 hours

REFERENCE BOOKS:

- R1: Gambhir.M. L, "Concrete Technology", Tata McGraw hill book Co.ltd., Delhi, 5th Edition,2013.
- R2: Neville. A M., "Properties of Concrete", Longman, 5th Edition, 2011.
- R3: ACI 214, Recommended Practice for evaluation of the strength test results of concrete American Concrete Institute,Farmington Hills,MI, www.concrete.org.
- R4: M.S.Shetty."Concrete Technology" S.Chand publication, New Delhi, 2010.

COURSE OUTCOMES:

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

CO 1	Develop knowledge on various physical properties of construction materials	K2
CO 2	Evaluate the workability, strength test parameters of fresh and hardened concrete	K5
CO 3	Compare and infer the results of the destructive and non-destructive testing procedures	K3
CO 4	Design the mix design for different types of concrete	K3
CO 5	Determining the durability concept of concrete	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	PO 8	P09	PO 10	PO 11	PO 12	PS01	PS02
C01	2	3	3	2	3	1	-	1	2	3	-	3	2	1
C02	3	3	3	2	3	2	-	1	2	3	-	3	2	1
C03	3	3	2	2	3	1	-	-	2	1	-	3	3	1
C04	3	3	3	2	3	2	-	1	2	3	-	3	2	2
C05	3	3	3	2	3	2	-	1	2	3	-	3	3	2
Average	2.8	3.0	2.8	2.0	3.0	1.6	-	1.0	2.0	2.6	-	3.0	2.4	1.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓		✓	✓	✓

22CPD204	PERSONALITY DEVELOPMENT IV	L	T	P	Credits
		2	0	0	2

COURSE OBJECTIVES:

- To enhance the soft skills and prepare them towards the skills needed for their career.

UNIT I	SOFT SKILLS	6
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Assertiveness – Meaning – Importance of assertiveness – Characteristics of Assertive communication – Merits – forms of assertion – Causes of misunderstanding

UNIT II	COMMUNICATION SKILLS	6
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Meaning – Elements of Communication – Functions of Communication – Principles of Communication
Formal and Informal Communication – Barriers in Communication – Characteristics of good –
communication – Feedback – Communication systems.

UNIT III	PRESENTATION SKILLS	6
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Meaning – Importance of Presentation – Concept of 5 W's and one H – understanding the audience –Types of presentations – How to make effective presentation.

UNIT IV	PRESENTATION SKILLS II	6
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Use of slide, PPT's and visuals – Rules for slide presentation – precautions – seminars and conferences – Steps to eliminate Stage fear.

UNIT V	CHANGE MANAGEMENT	6
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Definition – Necessity – Resistance towards Change – 10 Principles of Change Management – Leaders approach – Effective Change management.

TOTAL: 30 Hours

TEXT BOOKS:

- T1. LaClair, J. and Rao, R. Helping Employees Embrace Change, McKinsey Quarterly, 2002, Number 4.
T2. Spencer Johnson, Who Moved My Cheese, Vermilion, First edition
T3. Adair, John, Effective Communication, London: Pan Macmillan Ltd., 2003.

REFERENCE BOOKS:

- R1. Bovee, Courtland L, John V. Thill & Barbara E. Schatzman. Business Communication Today, Tenth Edition. New Jersey: Prentice Hall, 2010.

WEBLINKS:

1. <https://www.thebalancecareers.com/communication-skills-list-2063779>

2. <https://www.mindtools.com/page8.html>

COURSE OUTCOMES

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

C01:	Be assertive in their communication.	K3
C02:	Differentiate the principles of formal and informal communication.	K4
C03:	Make an effective presentation by understanding the audience.	K3
C04:	Practice the rules of presentation using slides, PPT's and visuals.	K3
C05:	Discuss the principles of change management.	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
C01	-	-	-	-	-	-	-	-	2	3	-	3	3	-
C02	-	-	-	-	-	-	-	-	2	3	-	3	3	-
C03	-	-	-	-	-	-	-	-	2	3	-	3	3	-
C04	-	-	-	-	-	-	-	-	2	3	-	3	3	-
C05	-	-	-	-	-	-	-	-	2	3	-	3	3	-
Average	-	-	-	-	-	-	-	-	2.0	3.0	-	3.0	3.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓	✓	✓	✓	✓	

22CMC071	ENGINEERING ECONOMICS, ESTIMATION & COSTING	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

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

- To understand the impact the cost of a structure.
- To understand the technical specifications for various works of the projects.

UNIT I INTRODUCTION 9

Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes (3 lectures)- Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates- Inflation and Phillips Curve. (2 lectures)

UNIT II COST CONTROL –TECHNIQUES 9

Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method

UNIT III INDIAN ECONOMY 9

Indian economy - Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.

UNIT IV PROCESS OF ESTIMATION 9

Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying

Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts-. Preparing Bids- Bid Price buildup- Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management -Workman's compensation, Contracts, Arbitration, Easement rights.

TOTAL: 45 hours**TEXT BOOKS:**

- T1: Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia
 T2: V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill
 T3: Misra, S.K. and Puri (2009), Indian Economy, Himalaya
 T4: Pareek Saroj (2003), Textbook of Business Economics, Sunrise Publishers
 T5: M Chakravarty, Estimating, Costing Specifications & Valuation
 T6: Joy P K, Handbook of Construction Management, Macmillan
 T7: B.S. Patil, Building & Engineering Contracts

REFERENCE BOOKS:

- R1: Relevant Indian Standard Specifications. 9. World Bank Approved Contract Documents.
 R2: FIDIC Contract Conditions.
 R3: Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration
 R4: Typical PWD Rate Analysis documents.
 R5: UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations, 2016
 R6: Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016

WEBLINKS:

1. https://onlinecourses.swayam2.ac.in/nou20_cs11/
2. <https://nptel.ac.in/courses/105103093>
3. <https://nptel.ac.in/courses/112107209>

COURSE OUTCOMES:

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

CO 1	Relate to the macro-economic concepts, price indices, interest rates and taxes	K2
CO 2	Perform the present worth, future worth and annual worth analyses on one of more economic alternatives	K5
CO 3	Evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives	K5
CO 4	Understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure	K2

CO 5	Apply the knowledge of competitive bidding on how to submit a competitive bid proposal	K3
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MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

		PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS 0 1	PS 0 2
C01	1	1	-	1	1	-	-	-	1	1	2	3	1	1
C02	2	3	3	3	1	-	-	1	1	3	3	3	3	3
C03	2	3	3	3	1	-	-	1	1	3	3	3	3	3
C04	-	-	-	2	-	-	-	-	2	-	3	3	3	3
C05	-	-	2	2	1	-	-	1	2	3	3	3	3	3
Average	1.7	2.4	2.7	2.2	1.0	-	-	1.0	1.4	2.5	2.8	3.0	2.6	2.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
		✓		✓	

COURSE OBJECTIVE

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

- To study the design and prepare the detailed estimate normally encountered in Civil Engineering practice.

LIST OF EXERCISES

1. Draw a Plan and Cross section of a Wall and calculate its Quantities.
2. Draw a Plan and Cross section of a single room of 5 m x 4 m (inner size), and Estimate the quantities of 1) Earthwork 2) Concrete in Foundation 3) Brickwork in foundation 4) Brickwork in Superstructure.
3. Draw a Plan and Cross section of a room by Long wall and Short wall method.
4. Draw a Plan and Cross section of a room using Centre line Method.
5. Estimate a Slab and Column.
6. Draw and prepare a detailed estimate of a septic tank for 25 users.
7. Draw and prepare a rough estimation for a double room in MS office Excel.
8. Work out the rate per unit for Cement concrete in foundation 1:4:10 for 10 cum.
9. Work out the rate per unit for Brickwork using I class bricks in CM 1: 4 for 10 cum.
10. Calculate the detailed estimate of a building.

TOTAL: 30 hours

REFERENCE BOOKS:

- T1: M Chakravarty, Estimating, Costing Specifications & Valuation
- T2: UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations, 2016
- T3: Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016

COURSE OUTCOMES:

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

CO 1	Determine the quantity required for construction of various building components	K5
CO 2	Compare the plan and cross section of the room drawn using various methods and select the optimum	K4
CO 3	Estimate the quantity required for slab, column and a double room	K5
CO 4	Deduct the cost estimate for brickwork and RCC foundation	K5
CO 5	Develop a detailed estimate for a building	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PS01	PS02
C01	2	3	3	2	3	-	-	1	2	3	3	3	2	3
C02	3	3	3	2	3	-	-	1	2	3	3	3	2	3
C03	3	3	3	2	3	-	-	1	2	3	3	3	3	3
C04	3	3	3	2	3	-	-	1	2	3	3	3	3	3
C05	3	3	3	2	3	-	-	1	2	3	3	3	3	3
Average	2.8	3.0	3.0	2.0	3.0	-	-	1.0	2.0	3.0	3.0	3.0	2.6	3.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓		✓	✓	✓

SYLLABUS
PROFESSIONAL ELECTIVE COURSES

22ECV101	PRESTRESSED CONCRETE STRUCTURES	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- Prestressed concrete is used extensively in bridges, multistory buildings and many other important parts of today's modern infrastructure.
- The inherent weakness of concrete intension is offset by introducing a pre-compression in a prestressed member.
- To improves its service load behavior such as reduced deflections and cracking.

UNIT I DESIGN FOR FLEXURE AND SHEAR 9

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

UNIT II	DEFLECTION AND DESIGN OF ANCHORAGE ZONE	9
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Factors influencing deflections – Short term deflections of uncracked members – Prediction of long-term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT III COMPOSITE BEAMS 9

Analysis and design of composite beams –Concordant cable and linear transformation –Calculation of stresses-Segmental construction in bridges

UNIT IV CONTINUOUS BEAMS 9

Methods of achieving continuity in continuous beams – Analysis for secondary moments – Principles of design.

UNIT V	TENSION AND COMPRESSION MEMBERS	9
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Role of prestressing in members subjected to Tensile forces and compressive forces – Design of tension and compression members – Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL: 45 hours

TEXT BOOKS:

- T1: Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, NewDelhi, 2062
T2: Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt.Ltd. 2012.

T3: Lin, Tung Yen, and Ned Hamilton Burns. Design of prestressed concrete structures. New York: Wiley, 1963.

REFERENCE BOOKS:

- R1: Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2012.
 R2: Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
 R3: Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition,Wiley India Pvt. Ltd., New Delhi, 2013.
 R4: IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards,NewDelhi, 2012
 R5: . IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards,New Delhi, 2012.

WEB LINKS:

1. <https://nptel.ac.in/courses/115102136>
2. <https://nptel.ac.in/courses/108106252>
3. <https://nptel.ac.in/courses/122106167>

COURSE OUTCOMES

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

CO 1	Design the prestressed concrete members for flexure and shear as per the relevant design code	K3
CO 2	Compute the deflection of prestressed concrete members and design the anchorage zone	K4
CO 3	Design of composite Prestress Concrete beams	K3
CO 4	Design of continuous prestress Concrete beams	K3
CO 5	Design of pre stressed concrete tension and compression members	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	3	-	-	-	-	-	-	-	-	-	-	-	3	-
C02	2	2	-	-	-	-	-	-	-	-	-	-	2	-
C03	3	-	-	-	-	-	-	-	-	-	-	-	3	-
C04	3	-	-	-	-	-	1	-	-	-	-	-	3	-
C05	3	-	-	-	-	2	2	-	-	-	-	-	3	-
Average	2.8	2.0	-	-	-	2.0	1.5	-	-	-	-	-	2.8	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓	✓		✓	✓

22ECV102	SPECIAL CONCRETES	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- To get exposed to behavioral aspects of concrete
- To get exposed to different types of concretes and their characteristics and applications.

UNIT I CHARACTERISTICS OF CONCRETE AND MIX DESIGN 9

Properties of fresh and hardened concrete - strength, elastic properties, creep and shrinkage - variability of concrete strength - quality control - Principles of concrete mix design, methods of concrete mix design - High Strength Concrete Mix Design - Super - Plasticizers - Principles involved in mix design of high performance concrete with fly ash or GGBS replacements.

UNIT II CONCRETING METHODS 9

Process of manufacturing of concrete-methods of transportation-placing and curing - extreme weather concreting - special concreting methods - vacuum dewatering - under water technology-special form work-Ready mix Concrete.

UNIT III POLYMER AND FIBER CONCRETES 9

Polymer concrete-Types, Properties and Applications - Blended cement concretesFibre-reinforced Concrete-Different types of metallic and non-metallic fibres - Types, Properties and Applications, Slurry-infiltrated fibre reinforced concrete.

UNIT IV FERROCEMENT, LOW AND HIGH DENSITY CONCRETES 9

Ferrocement and its applications, Light Weight concrete - High Density concrete - Roller compacted concrete - Types, Properties and Applications.

UNIT V OTHER CONCRETES 9

Bacterial concrete - Born again concrete (Recycled Aggregate concrete)-Electric concrete (Smart concrete) description - applications. High performance concrete. Production and applications-Self compacting concrete - Reactive powder concrete - Description, Properties and Applications.

TOTAL: 45 Hours

TEXT BOOKS:

- T1: Gupta. B. L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
- T2: Gambhir, M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
- T3: IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.

REFERENCE BOOKS:

- R1: Fintel, "Hand book of Concrete Enssi Vannostrand", CBS Publishers & Distributors, 2004.
- R2: Metha. P.K, and Monterio. P.J.M, "Concrete-Structures", Properties and Materials, 3rd Edition, McGraw Hill Professional, 2006.
- R3: Shetty. M.S, "Concrete Technology" Chand. S, and Company Ltd, Delhi, 2000.
- R4: Neville.A.M, "Properties of Concrete", Pitman Publishing Limited, London, 1990.
- R5: Aitkens, "High Performance Concrete", McGraw Hill, 1999.

WEB LINKS:

1. <https://nptel.ac.in/courses/115102169>
2. <https://nptel.ac.in/courses/108106199>
3. <https://nptel.ac.in/courses/122106120>

COURSE OUTCOMES

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

CO 1	Gain knowledge on limit state design concepts and joints	K2
CO 2	Understand the design of tension members for axial loading in braced system and unbraced system	K2
CO 3	Analyze the distribution of axial force on gusset and column base plate in bracing and column joints	K3
CO 4	Design the laterally supported and unsupported beams	K3
CO 5	Understand the concepts plastic analysis of structures	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	-	-	-	-	-	1	-	-	-	-	-	2	-
CO5	3	-	-	-	-	2	2	-	-	-	-	-	2	-
Average	2.4	-	-	-	-	2.0	1.5	-	-	-	-	-	2.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓	✓		✓	✓

		L	T	P	Credits
22ECV103	EARTHQUAKE ENGINEERING	3	0	0	3

COURSE OBJECTIVES

- To introduce the basics of Earthquake Engineering
- To introduce the engineering seismology, building geometrics & characteristics, structural irregularities
- To develop guidelines for earthquake engineering
- To discuss code provisions and their application on different types of structures

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 for mass as well as base excitation – Free vibration of SDOF system – Response to harmonic excitation – Impulse and response to unit impulse – Duhamel integral.

UNIT II	MULTIPLE DEGREE OF FREEDOM	9
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Two degree of freedom system – Normal modes of vibration – Natural frequencies of vibrations - Mode shapes - Introduction to Multiple degree of Freedom systems (MDOF) systems – Decoupling of equations of motion – Concept of mode superposition (No derivations).

UNIT III ELEMENTS OF SEISMOLOGY 9

Causes of Earthquake – Geological faults – Tectonic plate theory – Elastic rebound – Epicenter– Hypocenter– Primary, shear and Raleigh waves – Seismogram – Magnitude and intensity of earthquakes – Magnitude and Intensity scales – Spectral Acceleration - Information on some disastrous earthquakes

UNIT IV RESPONSE OF STRUCTURES TO EARTHQUAKE 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
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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 earthquake on structures.

TOTAL: 45 Hours

TEXT BOOKS:

- T1: Arya, A.S., ed., "Earthquake Engineering", Jai Krishna 60th Birthday Anniversary Commemoration Volume, ISET, Sarita Prakashan, Meerut, 1976.
- T2: Chopra, A.K., "Dynamics of Structures – Theory and Applications to Earthquake Engineering", 4th Edition, Pearson Education, 2014

T3: Wang, C. K., "Indeterminate structural analysis", Tata M New Delhi, 2010.

REFERENCE BOOKS:

- R1: Biggs, J.M., "Introduction to Structural Dynamics", McGraw-Hill Book Co., N.Y., 1965
 R2: Dowrick, D.J., "Earthquake Resistant Design", John Wiley & Sons, London, 1988
 R3: Paz, M., "Structural Dynamics – Theory & Computation", CSB Publishers & Distributors, Shahdara, Delhi, 2nd Edition, 2013, NPEEE Publications.
 R4: Rajasekaran. S, & G. Sankarasubramanian., "Computational Structural Mechanics", PHI Learning Pvt. Ltd, 2015
 R5: Negi L.S.and Jangid R.S.,Structural Analysis, Tata McGraw Hill Publishing Co.Ltd.2004

WEB LINKS:

1. <https://nptel.ac.in/courses/11510295>
2. <https://nptel.ac.in/courses/108106210>
3. <https://nptel.ac.in/courses/122106245>

COURSE OUTCOMES

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

CO 1	Apply the basics of Earthquake Engineering	K3
CO 2	Demonstrate the dynamics of structural system under earthquake load	K4
CO 3	Understand the principles of earthquake resistant design	K2
CO 4	Analyze the influence of the structural / geometrical design in building characteristics	K4
CO 5	Design the beam column junctions in buildings subjected to earthquake	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P 04	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PS01	PS02
C01	2	3	-	-	-	-	-	-	2	-	-	-	3	-
C02	3	-	-	-	-	-	-	-	2	-	-	2	3	-
C03	2	3	-	-	-	-	-	-	2	-	-	2	3	-
C04	3	-	-	-	-	-	-	-	2	-	-	2	3	-
C05	3	-	-	-	-	-	-	-	2	-	-	2	3	-
Average	2.6	3.0	-	-	-	-	-	-	2.0	-	-	2.0	3.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓	✓		✓	✓

22ECV104	METAL STRUCTURE BEHAVIOUR	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- To describe the behavior members towards various types of loading and their failure.
- To design connections for various structural systems and including loading condition separately & combined medium

UNIT I INTRODUCTION TO METAL AND CONNECTIONS 9

Metal properties, Load and stresses- Advantages and Disadvantages, Connections- Bolts - Bearing Types & Slip critical type, Plate joints- Lap joint & Butt joints- Single Cover- Double Cover butt joint. Weld – Properties- Fillet weld & Butt weld.

UNIT II BEHAVIOUR OF LOADING AND CONNECTIONS 9

Metals behavior on loading through connections – Yielding, Rupture, Block shear failures, Dispersion medium in bolts and plates- Buckling – Crippling- Minor axis bending of metals, Prying failure in T-section members.

UNIT III SIMPLE CONNECTIONS 9

Design of Shear connections for Rolled sections and Built up sections - Beam to Column Flange orientation, Column web Orientation, Beam to beam connections, Design of Moment connections – Directly weld and Plate connections- Beam to column & Beam to Beam Connections Both orientation.

UNIT IV PLATE GIRDERS AND BRACED MEMBERS 9

Design of Plate Girders- Laterally Supported & unsupported, Braced frames- Types of Bracing – K bracing- X bracing- Knee bracing- Chevron bracing and their design. Design of gusset plate- dispersion medium

UNIT V COMBINED BEHAVIOUR IN MEMBERS 9

Design of members for shear and tension in same medium- Combined effects- Resultant stress in bolts and members

TOTAL: 45 Hours

TEXT BOOKS:

- T1: P. Purushothaman, Reinforced Concrete Structural elements – Behaviour, Analysis and Design, Tata McGraw Hill Publ. Co. Ltd., New Delhi, 1984.
- T2: Pasala Dayaratnam, Design of Steel Structure, A.H. Wheeler & Co Ltd., 1990.
- T3: Dayaratnam, P., “Design of Steel Structures”, Second edition, S. Chand & Company, 2007.

REFERENCE BOOKS:

- R1: Henn W. Buildings for Industry, vols.I and II, London Hill Books, 1995.

R2: Handbook on Functional Requirements of Industrial buildings, SP32 – 1986, Bureau of Indian Standards, New Delhi 1990.

R3: Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982

R4: Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013

R5: Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2015

WEB LINKS:

1. <https://nptel.ac.in/courses/115102117>
2. <https://nptel.ac.in/courses/108106193>
3. <https://nptel.ac.in/courses/122106074>

COURSE OUTCOMES

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

CO 1	Analyze the Bolted and welded connection for the given loading condition	K4
CO 2	Understand the design of tension members for axial loading in braced system and unbraced system	K2
CO 3	Design members for various loadings and failure patterns as per codal provisions	K3
CO 4	Design members for both shear and moment connections	K3
CO 5	Design of plate girders based on support conditions	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PS01	PS02
CO1	2	-	-	-	-	-	-	-	1	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	2	-	-	2	3	-
CO3	3	-	-	-	-	-	-	-	2	-	-	2	3	-
CO4	3	-	-	-	-	-	-	-	2	-	-	2	3	-
CO5	3	-	-	-	-	-	-	-	2	-	-	2	3	-
Average	2.8	-	-	-	-	-	-	-	1.8	-	-	2.0	3.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓	✓		✓	✓

	L	T	P	Credits
22ECV105	3	0	0	3

SOIL MECHANICS-I

COURSE OBJECTIVES

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

- To assess soil behavior with the mineralogy present and advanced soil testing of soils such as in thermal, chemical, magnetic fields.
- To do seepage analysis for finding discharge calculation and stability.

UNIT I INTRODUCTION & SOIL CLASSIFICATION 9

Origin, Nature and type of Soils, its formation and deposition – Terminology of different types of soil– Phase system- Volume- Weight Relationship- terms of weight, volume, void ratio and porosity-Basic Definition and Relationship- Determination of various parameters: Moisture content, Unit Weight, Specific Gravity-- Particle size Analysis- Sieve analysis – Stoke's Law- Sedimentation Analysis -- Soil Classification for engineering purposes – Particle size Classification, Textural classification, Unified soil Classification and Indian Standard Classification System – Field Identification of soils- Clay Mineralogy- Base Exchange Capacity

UNIT II PLASTICITY CHARACTERISTICS OF SOIL 9

Plasticity of Soils- Consistency limits – Liquid Limit- Cone Penetrometer Method- Plastic limit- Shrinkage Limit- Method of Determination of Shrinkage limit- Plasticity, Liquidity and Consistency Indexes– Measurement of Consistency- Sensitivity- Thixotropy- Activity of Soils- Compaction- Standard Proctor Test- Factors affecting Compaction

UNIT III SOIL WATER & PERMEABILITY OF SOIL 9

Soil water – Various forms – Influence of clay minerals – Capillary rise – Suction - Effective stress concepts in soil – Total, neutral and effective stress distribution in soil in effect of Water table - Permeability – Darcy's Law, Permeability measurement in the laboratory and Field methods- Factors affecting permeability – Seepage Velocity- Quick sand condition – Seepage Analysis – Laplace Equation- Introduction to flow nets – Properties and uses – Permeability of Stratified Soil Deposits- Application to simple problems.

UNIT IV STRESS DISTRIBUTION 9

Stress distribution in soil media – Boussinesq's formula – stress due to point load, line load and strip load, uniformly loaded circular and rectangular loaded area – Newmark's Influence charts – Westergaard equation for point load- Contact pressure under rigid and flexible area – Theory of compaction- Laboratory Determination of Optimum moisture content and maximum dry density- Factors affecting compaction

UNIT V SHEAR STRENGTH & CONSOLIDATION 9

Introduction on Consolidation- Comparison of Compaction and Consolidation- Components of settlement- Immediate and consolidation settlement - Terzaghi's one dimensional consolidation theory – governing

differential equation - laboratory consolidation test- Shear strength of cohesive and cohesionless soils - Mohr - Coulomb failure theory – Saturated soil - Strength parameters - Measurement of shear strength, direct shear, Triaxial compression, UCC and Vane shear tests –Types of shear tests based on drainage and their applicability - Drained and undrained behaviour of clay and sand.

TOTAL: 45 Hours

TEXT BOOKS:

T1: Punmia P.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd., 16th Edition, New Delhi, 2005.

T2: Venkatramaiah, C. “Geotechnical Engineering”, New Age International Publishers, New Delhi, 2010.

REFERENCE BOOKS:

R1: McCarthy D.F., “Essentials of Soil Mechanics and Foundations Basic Geotechniques”, Sixth Edition, Prentice-Hall, New Jersey, 2002.

R2: Das, B.M, “Principles of Geotechnical Engineering”, (fifth edition), Thomas Books, 2005

R3: Muni Budhu, “Soil Mechanics and Foundations”, John Willey & Sons, Inc, New York, 2008.

WEB LINKS:

➤ <https://nptel.ac.in/courses/105105168>

➤ <https://nptel.ac.in/courses/105103207>

COURSE OUTCOMES

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

CO 1	Understand the site soil condition by classifying and identifying the index properties of soil	K2
CO 2	Understand the plasticity behavior and activity of clay soil	K2
CO 3	Determine and calculate the effective permeability on stratified soil	K4
CO 4	Compute the vertical stress in a semi-infinite soil mass and plot the stress distribution diagram	K3
CO 5	Evaluate ground settlements against time and stiffness of soil using shear strength parameters	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	2	1	2	2	-	-	-	-	-	-	-	3	-	2
C02	2	2	2	2	-	-	-	-	-	-	-	3	-	2
C03	3	2	3	3	-	-	-	-	-	-	-	3	2	3
C04	3	3	3	3	-	-	-	-	-	-	-	3	2	3
C05	3	2	3	3	-	-	-	-	-	-	-	3	2	3
Average	2.6	2.0	2.6	2.6	-	-	-	-	-	-	-	3.0	2.0	2.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✓	✓

		L	T	P	Credits
22ECV106	SOIL MECHANICS-II	3	0	0	3

COURSE OBJECTIVES

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

- To assess the general behavior of soil in slope stability and earth pressure
- To analyze the lateral forces acting on substructure.

UNIT I **SLOPE STABILITY** 9

Introduction-Stability Analysis of Infinite slopes- Stability Analysis of finite slopes- Culmann's Method for planar failure surface- Swedish Slip circle Method- Friction Circle Method- Stability of Slopes of Earth Dam- Taylor's Stability Number and Stability Curves- Bishop's Method

UNIT II EARTH PRESSURE 9

Introduction- Plastic Equilibrium in soils: Active and Passive States- Earth Pressure at rest- Rankine's Theory- Coulomb's Wedge Theory- Rebhann's Graphical Method- Culmann's Graphical Method

UNIT III RETAINING WALL & SHEET PILES 9

Introduction- Types of Retaining Walls- Principles of Design of Retaining Wall- Gravity Retaining Wall- Counterfort Retaining wall- Modes of failure of Retaining wall- Types of sheet pile walls- Design of Free cantilever sheet pile

UNIT IV BRACED CUTS AND COFFERDAMS 9

Introduction- Lateral Earth Pressure on Sheet-piling- Different Types of Sheet-piling and Bracing Systems- Design of various components of Bracings- Types of Cofferdam

UNIT V	DRILLED PIERS AND CAISSONS	9
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Drilled Piers- Construction of Drilled Piers – Advantages & Disadvantages- Design & Construction of Open Caissons- Pneumatic Caissons- Floating Caissons- Stability Analysis

TOTAL: 45 Hours

TEXT BOOKS:

- T1: Punmia P.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd., 16th Edition, New Delhi, 2005.
- T2: Venkatramaiah, C. “Geotechnical Engineering”, New Age International Publishers, New Delhi, 2010.

REFERENCE BOOKS:

- R1: McCarthy D.F., “Essentials of Soil Mechanics and Foundations Basic Geotechniques”, Sixth Edition, Prentice-Hall, New Jersey, 2002.
- R2: Das, B.M, “Principles of Geotechnical Engineering”, (fifth edition), Thomas Books, 2005
- R3: Muni Budhu, “Soil Mechanics and Foundations”, John Willey & Sons, Inc, New York, 2008.

WEB LINKS:

- <https://nptel.ac.in/courses/105105168>
- <https://nptel.ac.in/courses/105103207>

COURSE OUTCOMES

At the end of this course, the student will be able to

CO 1	Acquainted with stability analysis of slopes	K2
CO 2	Determine the earth pressures on foundations and other substructure	K3
CO 3	Understand the principles of Retaining wall	K2
CO 4	Understand the types of sheeting and cofferdam	K2
CO 5	Evaluate stability Analysis of Caissons	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
CO1	2	1	2	2	-	-	-	-	-	-	-	3	-	2
CO2	2	2	2	2	-	-	-	-	-	-	-	3	-	2
CO3	3	2	3	3	-	-	-	-	-	-	-	3	2	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO5	3	2	3	3	-	-	-	-	-	-	-	3	2	3
Average	2.6	2.0	2.6	2.6	-	-	-	-	-	-	-	3.0	2.0	2.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✓	✓

		L	T	P	Credits
22ECV107	FOUNDATION ENGINEERING	3	0	0	3

COURSE OBJECTIVES

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

- To impart knowledge on common method of sub soil investigation and design of foundation and acquires the capacity to investigate the soil condition and to select a suitable foundation.
- To learn about types and purposes of different foundation systems and structures.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration-auguring and boring – Water boring and rotatory drilling – Depth of boring – Spacing of bore hole - Sampling – Representative and undisturbed sampling – sampling techniques – Split spoon sampler, Thin tube sampler, Stationary piston sampler – Bore log report – Penetration tests (SPT and SCPT) – Data interpretation (Strength parameters and Liquefaction potential) - Selection of foundation based on soil condition.

UNIT II SHALLOW FOUNDATION 9

Introduction – Location and depth of foundation – codal provisions – Types of foundation – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems - Bearing Capacity from insitu tests (SPT, SCPT and plate load) – Allowable bearing pressure

UNIT III FOOTINGS AND RAFTS 9

Contact pressure distribution below footings and Contact pressure distribution below raft – Isolated footings and combined footings – Types and proportioning - Mat foundation– Types, applications uses and proportioning- floating foundation.

UNIT IV DEEP FOUNDATION 9

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil - Static formula - dynamic formulae (Engineering news and Hiley's) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – uplift capacity – Group capacity by different methods (Feld's rule, Converse Labara formula and block failure criterion) -- Interpretation of pile load test – Forces on pile caps – under reamed piles – Capacity under compression and uplift

UNIT V SETTLEMENT OF SHALLOW AND DEEP FOUNDATION 9

Settlement – Components of settlement – Determination of settlement of foundations on granular and clay deposits – Allowable settlements – Codal provision – Methods of minimizing settlement, differential settlement- Settlement of pile groups

TOTAL: 45 Hours

TEXT BOOKS:

T1: Punmia, B.C., "Soil Mechanics and Foundations", Laxmi publications pvt. Ltd., New Delhi, 6th Edition, 2005.

T2: Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", UBS Publishers Distribution Ltd, New Delhi, 1 st Edition, 2008.

T3: Varghese .P.C, "Foundation Engineering", PHI Learning Pvt Ltd, New Delhi, 2005.

REFERENCE BOOKS:

R1: Das, B.M. "Principles of Foundation Engineering, Thomson Books / COLE, 7th edition, 2010.

R2: Venkatramaiah,C."Geotechnical Engineering", New Age International Publishers, New Delhi, 2010.

WEB LINKS:

➤ <https://nptel.ac.in/courses/105105176>

➤ <https://nptel.ac.in/courses/105101083>

COURSE OUTCOMES

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

CO 1	Evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behavior	K5
CO 2	Calculate the bearing capacity of soils	K3
CO 3	Evaluate the contact pressure of soil at different points	K5
CO 4	Understand the forces acting on the pile foundation	K2
CO 5	Understand the Settlement of shallow and deep foundation	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	1	2	2	-	-	-	-	-	-	-	3	-	2
CO2	2	2	2	2	-	-	-	-	-	-	-	3	-	2
CO3	3	2	2	3	-	-	-	-	-	-	-	3	2	2
CO4	3	2	2	3	-	-	-	-	-	-	-	3	2	2
CO5	2	2	2	3	-	-	-	-	-	-	-	3	2	3
Average	2.4	1.8	2.0	2.6	-	-	-	-	-	-	-	3.0	2.0	2.2

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✓	✓

		L	T	P	Credits
22ECV108	GROUND IMPROVEMENT TECHNIQUES	3	0	0	3

COURSE OBJECTIVES

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

- To assess the general behavior of soil in slope stability and earth pressure
- To analyze the lateral forces acting on substructure.

UNIT I PROBLEMATIC SOIL AND GROUND IMPROVEMENT TECHNIQUES 9

Ground improvement - Role of ground improvement in foundation engineering – methods of ground improvement –geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

UNIT II DEWATERING 9

Dewatering Techniques - Well points – Vacuum and electro-osmotic methods – Seepage analysis for two dimensional flow - fully and partially penetrated slots inhomogeneous deposits (Simple cases only).

UNIT III GROUND IMPROVEMENT METHODS 9

In-situ densification of cohesion-less soils and consolidation of cohesive soils: Dynamic compaction Vibroflotation, Sand compaction piles. Consolidation: Preloading with sand drains, and fabric drains, Stone columns - Lime piles installation techniques only – relative merits and limitations – deep soil mixing.

UNIT IV GROUTING TECHNIQUE 9

Grouting - Types of grouts – Suspension grouts - solutions grouts – Grouting equipment and method - Grouting with soil, Bentonite - cement mixes and asphalt - Grout monitoring schemes.

UNIT V GEOSYNTHETICSAPPLICATIONS 9

Geosynthetics - Types – functions of Geotextiles – Separation – Filtration –Drainage - reinforcement - Geomembranes - Containments and barriers -Application to Ground Anchors.

TOTAL: 45 Hours

TEXT BOOKS

- T1. Purushothama Raj .P, “Ground Improvement Techniques”, Laxmi Publications (P) Ltd.,New Delhi, 2000.

REFERENCE BOOKS

- R1: Koerner .R.M, “Construction and Geotechnical Methods in Foundation Engineering”, McGraw Hill, New York, 1984.
- R2: Moseley .M.P, “Ground Improvement”, Blockie Academic and Professional,Chapman and Hall, Glassgow, 1998.

R3: Winterkorn .H.F and Fang .H.Y, “Foundation Engineering Hand Book”, Van Nostrand Reinhold, 1994.

WEB LINKS:

- <https://nptel.ac.in/courses/105105168>
- <https://nptel.ac.in/courses/105103207>

COURSE OUTCOMES

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

CO 1	Identify the problematic soil and select proper ground improvement techniques	K2
CO 2	Analysis the flow pattern in subsoil and implement dewatering techniques	K4
CO 3	Understand the different forms of ground improvement techniques	K2
CO 4	Understand the grouting method and techniques adopted in grouting	K2
CO 5	Understand the basic concepts of Geosynthesis	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	2	1	2	2	-	-	-	-	-	-	-	3	-	2
C02	2	2	2	2	-	-	-	-	-	-	-	3	-	2
C03	3	2	3	3	-	-	-	-	-	-	-	3	2	3
C04	3	3	3	3	-	-	-	-	-	-	-	3	2	3
C05	3	2	3	3	-	-	-	-	-	-	-	3	2	3
Average	2.6	2.0	2.6	2.6	-	-	-	-	-	-	-	3.0	2.0	2.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✓	✓

- T2: Daniel, B.E., Geotechnical Practice for waste disposal, Chapman and Hall, London, 1993.
- T3: Proceedings of the International symposium of Environmental Geotechnology (Vol.I and II), Environmental Publishing Company, 1986 and 1989.

REFERENCE BOOKS

- R1: Ott, W.R., Environmental Indices, Theory and Practice, Ann. Arbor, 1978.
- R2: Fried, J.J., Ground Water Pollution, Elsevier, 1975.
- R3: ASTM Special Technical Publication 874, Hydraulic Barrier in Soil and Rock, 1985.
- R4: Westlake, K., (1995), Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.
- R5: Lagrega, M.D., Buckingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill, Inc. Singapore, 1994.

WEB LINKS:

- <https://nptel.ac.in/courses/105105168>
- <https://nptel.ac.in/courses/105103207>

COURSE OUTCOMES

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

CO 1	To understand the behavior of pollutants in soil	K2
CO 2	To explore an idea about Geosynthesis	K3
CO 3	To realize the transportation and transformation of contaminants	K2
CO 4	To know the mechanism of solid wastes & its influence in soil stabilization	K2
CO 5	To know the basic remediation techniques	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	2	1	2	2	-	-	-	-	-	-	-	3	-	2
C02	2	2	2	2	-	-	-	-	-	-	-	3	-	2
C03	3	2	3	3	-	-	-	-	-	-	-	3	2	3
C04	3	3	3	3	-	-	-	-	-	-	-	3	2	3
C05	3	2	3	3	-	-	-	-	-	-	-	3	2	3
Average	2.6	2.0	2.6	2.6	-	-	-	-	-	-	-	3.0	2.0	2.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✓	✓

		L	T	P	Credits
2ECV110	ENVIRONMENTAL ENGINEERING	3	0	0	3

COURSE OBJECTIVES

- To realize the different water treatment techniques and sludge management and to understand the advanced water treatment techniques

UNIT I PLANNING FOR WATER SUPPLY SYSTEM 9

Public water supply system - Planning - Objectives - Design period - Population forecasting – Water demand -Sources of water and their characteristics - Surface and Groundwater- Impounding Reservoir Well hydraulics - Development and selection of source – Water quality - Characterization - Water quality standards

UNIT II WATER TREATMENT 9

Objectives - Unit operations and processes -Principles, functions design and drawing of Flash mixers, flocculator, sedimentation tanks and sand filters -Disinfection- Residue Management.

UNIT III SEWER DESIGN 9

Sewerage – Hydraulics of flow in sewers – Objectives – Design period - Design of sanitary and storm sewers – Small bore systems - Computer applications – Laying, joining & testing of sewers – appurtenances – Pumps – selection of pumps and pipe Drainage -. Plumbing System for Buildings – One pipe and two pipe system

UNIT IV PRIMARY TREATMENT OF SEWAGE 9

Objective – Unit Operation and Processes – Selection of treatment processes – Onsite sanitation - Septic tank, Grey water harvesting – Primary treatment – Principles, functions design and drawing of screen, grit chambers and primary sedimentation tanks – Operation and Maintenance aspects

UNIT V SECONDARY TREATMENT OF SEWAGE AND SLUDGE MANAGEMENT 9

Objective – Selection of Treatment Methods – Principles, Functions, Design and Drawing of Units - Activated Sludge Process and Trickling filter, other treatment methods – Oxidation ditches, UASB – Waste Stabilization Ponds – Reclamation and Reuse of sewage – Recent Advances in Sewage Treatment – Construction and Operation & Maintenance of Sewage Treatment Plants. Objectives of sludge treatment - properties and characteristics of sludge - Thickening - sludge digestion - drying beds - conditioning and dewatering - sludge disposal -elutriation.

TOTAL: 45 Hours

TEXT BOOKS:

- T1: Garg, S.K., “Environmental Engineering”, Vol.1 Khanna Publishers, New Delhi, 2011
T2: Punmia, B.C., Ashok K Jain and Arun K Jain, “Water Supply Engineering”, Laxmi Publications (P)

REFERENCE BOOKS:

- R1: Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2003.
- R2: Syed R.Qasim and Edward M.MotleyGuang Zhu, Water Works Engineering
- R3: Planning, Design and Operation, Prentice Hall of India Private Limited, New Delhi – 2006.

WEB LINKS:

- <https://nptel.ac.in/courses/105105201>
- <https://nptel.ac.in/courses/105106119>
- <https://nptel.ac.in/courses/103107084>

COURSE OUTCOMES

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

CO 1	Understand the planning of water supply, objectives design period and population forecasting	K2
CO 2	Understand basics and design the unit operation and processes that are used in water treatment	K2
CO 3	Understand the construction, operation & maintenance aspects of water treatment	K2
CO 4	Understand the principles of primary treatment and its functions	K2
CO 5	Acquire knowledge of secondary treatment technology and sludge management	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS 01	PS 02
CO1	2	1	2	1	1	3	2	2	3	3	3	3	3	2
CO2	2	1	2	1	1	3	2	2	3	3	3	3	3	3
CO3	2	1	2	1	1	3	2	2	3	3	3	3	3	3
CO4	2	1	2	1	1	3	2	2	3	3	3	3	3	3
CO5	2	1	2	1	1	3	3	2	3	3	3	3	3	3
Average	2.0	1.0	2.0	1.0	1.0	3.0	2.2	2.0	3.0	3.0	3.0	3.0	3.0	2.8

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓			✓	✓

		L	T	P	Credits
22ECV111	AIR AND NOISE POLLUTION CONTROL	3	0	0	3

COURSE OBJECTIVES

- To impart knowledge on the effects of air pollutants on atmosphere and understand the different modelling techniques employed for air pollution monitoring.
- To impart knowledge on the principles and design of control of indoor/ particulate / gaseous air pollutant and its emerging trends

UNIT I INTRODUCTION 9

Structure and composition of Atmosphere – Sources and classification of air pollutants - Effects of air pollutants on human health, vegetation & animals, Materials & Structures – Effects of air Pollutants on the atmosphere, Soil & Water bodies – Long- term effects on the planet – Global Climate Change, Ozone Holes – Ambient Air Quality and Emission Standards – Air Pollution Indices – Emission Inventories – Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants

UNIT II AIR POLLUTION MONITORING AND MODELLING 9

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns - Transport & Dispersion of Air Pollutants – Modeling Techniques – Instrumentation – Sampling techniques – Stack monitoring – Air Pollution Climatology.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Gas Particle Interaction, – Working principle, Design and performance equations of Gravity Separators (cyclone) , Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations – Process Control and Monitoring – Costing of APC equipment – Case studies for stationary and mobile sources.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations - Costing of APC Equipment – Case studies for stationary and mobile sources.

UNIT V AUTOMOBILE AND NOISE POLLUTION 9

Vehicular Pollution: Automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution. Noise Pollution: Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures. Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control

TOTAL: 45 hours

TEXT BOOKS:

- T1: Anjaneyulu. Y, "Air Pollution & Control Technologies" Allied Publishers (P) Ltd.,India, 2002
- T2: Noel de Nevers, "Air Pollution Control Engg"., Mc Graw Hill, New York, 1995

REFERENCE BOOKS:

- R1: Arthur C.Stern, „Air Pollution (Vol.I – Vol.VIII)“, Academic Press, 2006. 3. Daniel Vallero “ Fundamentals of Air Pollution”, Fourth Edition,2008
- R2: David H.F. Liu, Bela G. Liptak „Air Pollution“, Lweis Publishers, 2000.

WEB LINKS:

- <https://nptel.ac.in/courses/105102089>
- <https://nptel.ac.in/courses/105104099>
- https://onlinecourses.nptel.ac.in/noc22_ce22/preview

COURSE OUTCOMES

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

CO 1	Understand the structure and composition of atmosphere and its effect on human health, vegetation and animals	K2
CO 2	Identify various air pollution modelling techniques and understand meteorology	K2
CO 3	Identify appropriate control equipments for particulate contaminants	K2
CO 4	Identify proper control equipments for gaseous contaminants	K2
CO 5	Understand the consequences of vehicular and noise pollution	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	1	1	1	-	3	1	1	-	1	-	3	2	1
CO2	3	3	2	3	3	3	2	2	3	3	3	3	3	3
CO3	2	2	3	2	-	3	3	3	3	3	3	3	3	1
CO4	2	2	3	2	1	3	3	3	3	3	3	3	3	1
CO5	2	3	3	2	1	3	3	3	3	3	2	3	2	1
Average	2.0	2.2	2.4	2.0	1.7	3.0	2.4	2.4	3.0	2.6	2.8	3.0	2.6	1.4

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✓	✓

		L	T	P	Credits
22ECV112	SOLID AND HAZARDOUS WASTE MANAGEMENT	3	0	0	3

COURSE OBJECTIVES

- To impart knowledge on the elements of managing solid wastes from Municipal and industrial sources including the related engineering principles, design criteria, methods and equipments
- To educate the students about the different types of waste disposal techniques

UNIT I SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK 9

Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management -- Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes , plastics and fly ash – Elements of integrated waste management and roles of stakeholders - Financing and Public Private Participation for waste management.

UNIT II WASTE CHARACTERIZATION AND SOURCE REDUCTION 9

Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse

UNIT III STORAGE, COLLECTION AND TRANSPORT OF WASTES 9

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport

UNIT IV WASTE PROCESSING TECHNOLOGIES 9

Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes - Health considerations in the context of operation of facilities, handling of materials and impact of outputs on the environment

UNIT V WASTE DISPOSAL 9

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation – Incineration. Integrated waste management practices- case studies

TOTAL: 45 hours

TEXT BOOKS:

- T1: George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill International edition, New York, 1993

REFERENCE BOOKS:

- R1: CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000
- R2: William A. Worrell, P. Aarne Vesilind, Solid Waste Engineering, Cengage Learning, 2012
- R3: John Pitchtel, Waste Management Practices, CRC Press, Taylor and Francis Group, 2014

WEB LINKS:

- <https://nptel.ac.in/courses/105106056>
- <https://nptel.ac.in/courses/105103205>
- <https://nptel.ac.in/courses/105105160>

COURSE OUTCOMES

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

CO 1	Identify the sources and understand the need for solid and hazardous waste management and its regulatory framework	K2
CO 2	Identify the waste characterization and source reduction of waste generation	K2
CO 3	Understand in detail handling, segregation and transportation of waste at source	K2
CO 4	Analyze and select the appropriate waste processing technologies	K4
CO 5	Develop different disposal methods	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O 1	PS O 2
CO1	1	1	1	1	2	3	1	1	3	3	-	3	2	1
CO2	2	2	2	3	3	3	2	2	3	3	3	3	3	3
CO3	2	2	3	2	3	3	3	3	3	3	3	3	3	3
CO4	2	2	3	2	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	2	3	3	3	3	3	3	3	3	3	3
Average	1.8	2.0	2.4	2.0	2.8	3.0	2.4	2.4	3.0	3.0	3.0	3.0	2.8	2.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓			✓	✓

22ECV113	PHYSIO-CHEMICAL PROCESSES FOR WATER AND WASTEWATER TREATMENT	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- To impart knowledge on the selection criteria of a treatment system and its treatment principles.
- To train the students in the design of municipal and industrial water treatment plants.
- To educate the students on the design and working principles of various types of waste water treatment systems

UNIT I INTRODUCTION 5

Pollutants in water and wastewater – characteristics, Standards for performance - Significance of physico-chemical treatment – Selection criteria-types of reactor- reactor selection-batch continuous type-kinetics

UNIT II TREATMENT PRINCIPLES 10

Physical treatment - Screening – Mixing, Equalization – Sedimentation – Filtration – Evaporation – Incineration – gas transfer – mass transfer coefficient Adsorption – Isotherms – Membrane separation, Reverse Osmosis, Nano filtration, ultra filtration and hyper filtration electro dialysis, distillation – stripping and crystallization – Recent Advances. Principles of Chemical treatment – Coagulation flocculation - stabilization – Disinfection, Ion exchange, Electrolytic methods, Solvent extraction – advanced oxidation /reduction – Recent Trends.

UNIT III MUNICIPAL WATER TREATMENT PLANTS 10

Selection of Treatment – Design of municipal water treatment plant units – Aerators – chemical feeding – Flocculation – clarifier – filters – Rapid sand filters, slow sand filter, pressure filter, Displacement and gaseous type - Flow charts – Layouts – Hydraulic Profile, PID - construction and O&M aspects – case studies, Residue management – Upgradation of existing plants – Recent Trends.

UNIT IV INDUSTRIAL WATER TREATMENT PLANTS 10

Design of Industrial Water Treatment Units- Selection of process – Design of softeners – Demineralizers – Reverse osmosis plants –Flow charts – Layouts –Hydraulic Profile, PID - construction and O&M aspects – case studies, Residue management – Upgradation of existing plants – Treatment of water for boilers and cooling towers - Recent Trends

UNIT V WASTEWATER TREATMENT PLANTS 10

Design of municipal wastewater treatment units-screens-detritors-grit chamber-settling tanks sludge thickening-sludge dewatering systems-sludge drying beds - Design of Industrial Wastewater Treatment Units-Equalization- Neutralization-Chemical Feeding Devices-mixers floatation units-oil skimmer Flow charts – Layouts –Hydraulic Profile, PID, construction and O&M aspects – case studies, Retrofitting - Residue management – Upgradation of existing plants – Recent Trends.

TOTAL: 45 hours

TEXT BOOKS:

- T1: Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw Hill, New Delhi, IV Edition, 2003

REFERENCE BOOKS:

- R1: Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw Hill, New Delhi, IV Edition, 2003
- R2: F.R. Spellman, "Hand Book of Water and Wastewater Treatment Plant operations", CRC Press, New York, III Edition, 2013
- R3: Lee, C.C. and Shun dar Lin, "Handbook of Environmental Engineering Calculations", McGraw Hill, New York, II Edition, 2007.
- R4: Qasim, S.R., Motley, E.M. and Zhu.G, "Water works Engineering – Planning, Design and Operation", Prentice Hall, New Delhi, 2002.

WEB LINKS:

- https://onlinecourses.nptel.ac.in/noc22_ch25/preview
- https://onlinecourses.nptel.ac.in/noc22_ce76/preview

COURSE OUTCOMES

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

CO 1	Understand the characteristics of pollutants in water and waste water	K2
CO 2	Demonstrate physical treatment methods	K3
CO 3	Design the municipal water treatment plant units	K4
CO 4	Design the Industrial waste water Treatment Units	K3
CO 5	Design the municipal waste water treatment plant	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS 0 1	PS 0 2
C01	2	-	2	-	1	3	2	1	3	3	-	2	3	-
C02	2	-	2	-	1	3	2	1	3	3	-	2	3	-
C03	2	2	3	2	2	3	3	3	3	3	3	3	3	3
C04	2	2	3	2	2	3	3	3	3	3	3	3	3	3
C05	2	2	3	2	2	3	3	3	3	3	3	3	3	3
Average	2.0	2.0	2.6	2.0	1.6	3.0	2.6	2.2	3.0	3.0	3.0	2.6	3.0	3.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓			✓	✓

		L	T	P	Credits
21ECV114	ECOLOGICAL ENGINEERING	3	0	0	3

COURSE OBJECTIVES

- To impart knowledge on the elements of managing solid wastes from Municipal and industrial sources including the related engineering principles, design criteria, methods and equipment
- To educate the students about the different types of waste disposal techniques.

UNIT I ECOSYSTEMS & ECO TECHNOLOGY 10

Aim, scope and applications of ecology – Development and evolution of ecosystems – Principles and concepts pertaining to communities in ecosystem – Energy flow and material cycling in ecosystems – productivity in ecosystems.

UNIT II SYSTEMS APPROACH IN ECOLOGICAL ENGINEERING 10

Principles, components and characteristics of systems – Classification of systems – Structural and functional interactions of environmental systems – Environmental systems as energy systems – Mechanisms of steady-state maintenance in open and closed systems – Modelling and eco technology – Elements modeling – Modelling procedure – Classification of ecological models Applications of models in eco technology – Ecological economics.

UNIT III ECOLOGICAL ENGINEERING PROCESSES 8

Self-organizing design and processes – Multi seeded microcosms – Interface coupling in ecological systems – Concept of energy – Determination of sustainable loading of ecosystems.

UNIT IV ECO TECHNOLOGY FOR WASTE TREATMENT 12

Ecological engineering and ecotechnology – Classification of ecotechnology – Principles of ecological engineering. Ecosanitation-Principles and operation of soil infiltration systems – Wetlands and ponds – source separation systems – Aquacultural systems – Agro ecosystems – Detritus based treatment for solid wastes – Applications of ecological engineering for marine systems.

UNIT V CASE STUDIES 5

Case studies of Integrated Ecological Engineering Systems and their commercial prospects.

TOTAL: 45 Hours

TEXT BOOKS:

- T1: Mitsch, W.J. and S.E. Jorgenson. 2004. Ecological Engineering and Ecosystem Restoration. John Wiley and Sons, Hoboken, New Jersey, 411pp. ISBN: 978-0471332640
- T2: Jorgensen, S.E. Ecological Engineering: Principles and Practice. CRC Press, 2003

REFERENCE BOOKS:

- R1: Mitsch, J.W. and Jorgensen, S.E. Ecological Engineering – An Introduction to Ecotechnology, John Wiley & Sons, New York, 1989
- R2: Mitsch, W.J. Ecological Engineering and Ecosystem Restoration, Wiley 2nd Ed., 2003
- R3: White I.D., Mottershed, D.N. and Harisson, S.J. Environmental systems – An Introductory text, Chapman Hall, London, 1994

WEB LINKS:

- https://onlinecourses.nptel.ac.in/noc19_ge23/preview
- <https://nptel.ac.in/courses/127105018>

COURSE OUTCOMES

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

CO 1	Understand the principles of ecosystem	K2
CO 2	Study Structural and functional interactions of environmental systems	K2
CO 3	Familiarize in the processes in ecological ecosystem	K2
CO 4	Applications of eco Technology in ecological engineering process	K3
CO 5	Understand the Integrated Ecological Engineering Systems	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
C01	2	2	1	1	-	3	3	2	3	3	2	3	3	-
C02	3	3	3	2	3	3	3	2	3	3	3	3	3	3
C03	2	1	1	1	-	3	3	2	3	3	2	3	3	2
C04	2	2	2	1	-	3	3	2	3	3	3	3	3	3
C05	2	1	2	1	-	3	3	2	3	3	2	3	3	2
Average	2.2	1.8	1.8	1.2	3.0	3.0	3.0	2.0	3.0	3.0	2.4	3.0	3.0	2.5

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
✓			✓	✓	

22ECV115	IRRIGATION ENGINEERING	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

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

- To understand the different phases in irrigation practices, Planning and management of irrigation.
- To impart required knowledge on Irrigation storage, distribution systems 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 farm development works-Participatory irrigation management- Water resources associations- Changing paradigms in water management-Performance evaluation-Economic aspects of irrigation

TOTAL: 45 Hours

TEXTBOOKS:

- T1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
- T2. Punmia B.C., et. al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009
- T3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009

REFERENCES:

- R1: Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
- R2: Linsley R.K. and Franzini J.B., "Water Resources Engineering", McGraw-Hill Inc, 2000
- R3: Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw- Hill Inc., New Delhi, 1997.

WEB LINKS:

- <https://nptel.ac.in/courses/105105168>
- <https://nptel.ac.in/courses/105103207>

COURSE OUTCOMES

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

CO 1	Estimate duty delta relationship, consumptive needs for irrigation as per national water policy	K5
CO 2	Develop optimization techniques for different methods of irrigation	K3
CO 3	Design of sluices and weirs on permeable and impermeable foundation	K3
CO 4	Analyse the forces acting on dams and prepare elementary profile	K4
CO 5	Design of cross drainage works and river training works	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	2	1	2	2	-	-	-	-	-	-	-	3	-	2
C02	2	2	2	2	-	-	-	-	-	-	-	3	-	2
C03	3	2	3	3	-	-	-	-	-	-	-	3	2	3
C04	3	3	3	3	-	-	-	-	-	-	-	3	2	3
C05	3	2	3	3	-	-	-	-	-	-	-	3	2	3
Average	2.6	2.0	2.6	2.6	-	-	-	-	-	-	-	3.0	2.0	2.6

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✓	✓	✓	✓	✓	
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Open Book Test
			✓	✓	

SYLLABUS
PROFESSIONAL ELECTIVE
BLENDED COURSES

22ECV201	DESIGN OF STEEL STRUCTURES	L	T	P	Credits
		3	0	2	4

COURSE OBJECTIVES

- To determine safe as well as economical steel section for various industrial and framed structures.
- To learn the design of steel structures using Limit state method as per codal provision IS 800-2007.

UNIT I INTRODUCTION 9

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

UNIT II TENSION MEMBERS 9

Tension members – types of failure of tension members- Yielding failure – Rupture failure. Types of sections – Net cross sectional area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag

UNIT III COMPRESSION MEMBERS 9

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening type columns – Design of column bases – Gusseted base.

UNIT IV BEAMS AND PLATE GIRDERS 9

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

UNIT V PLASTIC ANALYSIS 9

Statically indeterminate structures – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism. Static and Kinematic methods – Upper and lower bound theorems -Plastic analysis of indeterminate beams and frames.

List of Exercises

1. Draw the layout of different types of Rivet connections.
2. Draw the neat sketch of staggered joints and show pitch, gauge and edge distance.
3. Draw the plan and elevation of tension splice.
4. Design the lacing and battening type columns
5. Draw the plan and elevation of slab base.
6. Draw the plan and elevation of Gusset base

TOTAL: 45 + 15 Hours

TEXT BOOKS:

- T1: Dayaratnam, P., —Design of Steel Structures||, Second edition, S. Chand & Company, 2007.
- T2: Ramachandra, S. and VirendraGehlot, —Design of Steel Structures – Vol. I & II||, Standard Publication, New Delhi, 2010.
- T3: Subramanian. N, "Design of Steel Structures", Oxford University Press, New Delhi, 2017.

REFERENCE BOOKS:

- R1: Teaching Resources for Structural Steel Design – Vol. I & II||, INSDAG,14th Edition, Kolkatta.
- R2: Gaylord, E.H., Gaylord, N.C., and Stallmeyer, J.E., —Design of Steel Structures||, 3rd edition, McGraw-Hill Publications, 1992
- R3: IS 800-2007 Indian Standard - General Construction in Steel – code of practice (3rd Revision).
- R4: Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013
- R5: Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company,2015

WEB LINKS:

- <https://nptel.ac.in/courses/115102102>
- <https://nptel.ac.in/courses/108106111>
- <https://nptel.ac.in/courses/1221060152>

COURSE OUTCOMES

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

CO 1	Gain knowledge on limit state design concepts and joints	K2
CO 2	Understand the design of tension members for axial loading in braced system and unbraced system	K2
CO 3	Analyze the distribution of axial force on gusset and column base plate in bracing and column joints	K3
CO 4	Design the laterally supported and unsupported beams	K3
CO 5	Understand the concepts plastic analysis of structures	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
C01	2	-	-	-	-	-	-	-	3	-	-	-	3	-
C02	2	-	-	-	-	-	-	-	2	-	-	2	3	-
C03	3	-	-	-	-	-	-	-	2	-	-	2	3	-
C04	3	-	-	-	-	-	-	-	2	-	-	2	3	-
C05	3	-	-	-	-	-	-	-	2	-	-	2	3	-
Average	2.6	-	-	-	-	-	-	-	2.2	-	-	2.0	3.0	-

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Observation
✓	✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation	Viva
✓	✓		✓	✓	✓

22ECV202	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	Credits
		3	0	2	4

COURSE OBJECTIVES:

- To familiarize concepts on traffic engineering and to provide exposure on various traffic control measures.
- To understand the design requirements of rotary and intersections

UNIT I INTRODUCTION 9

Significance and scope, Characteristics of Vehicles and Road Users, Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering- Road, Traffic and Land Use Characteristics, Impact of gadgets on road user behavior

UNIT II TRAFFIC SURVEYS AND ANALYSIS 9

Surveys and Analysis - Volume, Capacity, Speed and Delays, Origin and Destination, Parking, Pedestrian Studies, Accident Studies and Safety Level of Services- Basic principles of Traffic Flow.

UNIT III TRAFFIC CONTROL 9

Traffic signs, Road markings, Design of Traffic signals and Signal co-ordination (Problems), Traffic control aids and Street furniture, Street Lighting, Computer applications in Signal design

UNIT IV GEOMETRIC DESIGN OF INTERSECTIONS 9

Conflicts at Intersections, Classification of 'At Grade Intersections, - Channallised Intersections - Principles of Intersection Design, Elements of Intersection Design, Rotary design, Grade Separation and interchanges - Design principles.

UNIT V TRAFFIC MANAGEMENT 9

Traffic Management- Transportation System Management (TSM) - Travel Demand Management (TDM), Traffic Forecasting techniques, Restrictions on turning movements, One way Streets, Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes, Introduction to Intelligent Transportation System (ITS).

List of Exercises

1. Perform speed study and infer the vehicle speed distribution
2. Conduct a traffic volume study on a road and categorize the traffic volume
3. Perform a questionnaire survey among students for O-D study and compile the results
4. Draw the parking layout for a facility with the aid of parking inventory study
5. Identify the dark spots on the road and tabulate the reasons why accidents are repeatedly occurring at these spots
6. Develop a pedestrian questionnaire for improving an existing pedestrian facility

TEXT BOOKS:

1. Kadiyali L R, "Traffic Engineering and Transport Planning", Khanna Technical Publications, Delhi, 2008.
2. Khanna K and Justo C E G, "Highway Engineering", Khanna Publishers, Roorkee, 2001.

REFERENCE BOOKS:

1. Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management
2. Guidelines of Ministry of Road Transport and Highways, Government of India.
3. Subhash C.Saxena," A Course in Traffic Planning and Design", Dhanpat Rai Publications, New Delhi, 1989.

WEBLINKS:

- <https://www.irc.nic.in/>
- <https://morth.nic.in/manual-roads-wing>
- <https://ascelibrary.org/journal/jtepbs>

COURSE OUTCOMES

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

CO 1	Interpret the impact of various factors on road user behavior	K2
CO 2	Survey the existing facility for various traffic parameters and analyze the traffic data	K4
CO 3	Apply the results of the traffic studies and suggest measures for improving the existing facility	K4
CO 4	Design traffic signal system based on traffic volume count	K3
CO 5	Compare and select the best suited traffic management measure based on the site requirements	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
CO1	1	1	1	2	1	1	-	1	1	1	-	2	2	-
CO2	2	2	3	3	2	2	-	1	2	2	1	3	2	1
CO3	2	2	3	3	2	2	2	1	1	2	1	3	2	1
CO4	2	2	3	3	2	2	1	1	2	2	-	3	2	-
CO5	1	-	2	2	1	2	2	1	2	2	1	3	2	1
Average	1.6	1.8	2.4	2.6	1.6	1.8	1.7	1.0	1.6	1.8	1.0	2.8	2.0	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Observation
✓	✓	✓	✓	✓	✓
Quiz	Open Book Test	Projects	Seminars	Demonstration / Presentation	Viva
✓	✓			✓	✓

SYLLABUS
OPEN ELECTIVE COURSES
(MANAGEMENT)

22ECV151

ORGANIZATIONAL BEHAVIOUR

L	T	P	Credits
3	0	0	3

COURSE OBJECTIVES:

- To gain an idea on the roles played by individuals and groups in an organizational setup
- To understand the importance traits of leadership
- To familiarize the dynamics of work setup in an organization

UNIT I FOCUS AND PURPOSE

5

Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.

UNIT II INDIVIDUAL BEHAVIOUR

12

Personality – types – Factors influencing personality – Theories – Learning – Types of learners – The learning process – Learning theories – Organizational behaviour modification. Misbehaviour – Types – Management Intervention. Emotions - Emotional Labour – Emotional Intelligence – Theories. Attitudes – Characteristics – Components – Formation – Measurement- Values. Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management. Motivation – importance – Types – Effects on work behavior.

UNIT III GROUP BEHAVIOUR

10

Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – Team building – Interpersonal relations – Communication – Control.

UNIT IV LEADERSHIP AND POWER

8

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

UNIT V DYNAMICS OF ORGANIZATIONAL BEHAVIOUR

10

Organizational culture and climate – Factors affecting organizational climate – Importance. Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change. Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life. Organizational development – Characteristics – objectives – Organizational effectiveness

TOTAL: 45 Hours

TEXT BOOKS

1. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
2. Fred Luthans, Organisational Behavior, McGraw Hill, 11th Edition, 2001.

REFERENCE BOOKS

1. Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley, 9th Edition, 2008.
2. Udai Pareek, Understanding Organisational Behaviour, 2nd Edition, Oxford Higher Education, 2004.
3. Mc Shane & Von Glinov, Organisational Behaviour, 4th Edition, Tata Mc Graw Hill, 2007.
4. Hellrigal, Slocum and Woodman, Organisational Behavior, Cengage Learning, 11th Edition 2007.
5. Ivancevich, Konopaske & Maheson, Organisational Behaviour & Management, 7th edition, Tata McGraw Hill, 2008.

WEBLINKS:

1. <https://open.umn.edu/opentextbooks/textbooks/30>
2. <https://old.mu.ac.in/wp-content/uploads/2014/04/Management-PAPER-II-Organizational-Behavior-final-book.pdf>
3. https://en.wikipedia.org/wiki/Organizational_behavior

COURSE OUTCOMES (COs):

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

CO 1	Understand the various theories of behavior and behavior modifications	K2
CO 2	Infer the effects of values, attitudes, perceptions and perceptions on work behavior	K2
CO 3	Relate to the decision making process of group based on the group dynamics	K2
CO 4	Compare the role of leadership and the power associated with it	K2
CO 5	Outline the factors influencing the work-life balance and adapt to the various organizational changes	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P O 1	P O 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O 1	PS O 2
C01	-	-	-	1	-	1	-	2	2	2	-	2	1	-
C02	-	-	-	1	-	1	-	2	3	2	-	3	1	-
C03	-	-	-	1	-	1	-	2	3	3	-	3	3	-
C04	-	-	-	1	-	-	-	2	2	-	-	2	1	-
C05	-	-	-	2	-	-	-	2	3	2	-	3	3	1
Average	-	-	-	1.2	-	1.0	-	2.0	2.6	1.8	-	2.6	1.8	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓			✓	✓

COURSE OBJECTIVES

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

UNIT I	INTRODUCTION	9
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Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM.

UNIT II	TQM PRINCIPLES	9
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Leadership - Strategic quality planning, Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5s, Kaizen - Supplier, partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III	TQM TOOLS & TECHNIQUES I	9
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The seven traditional tools of quality - New management tools - Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV	TQM TOOLS & TECHNIQUES II	9
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Quality circles - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Cost of Quality - Performance measures.

UNIT V	QUALITY SYSTEMS	9
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Need for ISO 9000- ISO 9000-2000 Quality System - Elements, Documentation, Quality auditing- QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - Case studies of TQM, implementation in manufacturing and service sectors including IT.

TOTAL: 45 Hours

TEXT BOOKS:

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education Asia, 3rd Edition, Indian Reprint (2006).

REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2008.
2. Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2012.
3. Suganthi, L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

WEBLINKS:

1. <https://www.educba.com/total-quality-management-notes/>
2. https://www.academia.edu/37213047/TOTAL_QUALITY_MANAGEMENT_notes

COURSE OUTCOMES:

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

CO 1	Understand the concepts of TQM through the contributions of various experts	K2
CO 2	Develop continuous improvement process tools based on the need	K3
CO 3	Understand the concept and application of six sigma	K2
CO 4	Identify the tools required for manufacturing process and reasons for bench mark	K2
CO 5	Make use of QFD and codal provisions associated with quality systems	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS 01	PS 02
CO1	1	-	1	1	-	-	-	2	1	1	2	2	1	1
CO2	3	2	2	2	2	1	1	2	1	2	2	2	2	2
CO3	1	-	1	2	1	-	2	2	1	2	2	3	3	2
CO4	1	-	2	1	1	-	-	2	1	2	-	2	2	-
CO5	1	1	3	2	2	2	2	2	2	2	2	3	2	2
Average	1.4	1.5	1.8	1.6	1.5	1.5	1.7	2.0	1.2	1.8	2.0	2.4	2.0	1.8

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓	✓			✓

COURSE OBJECTIVES

- To understand the nature of E-Commerce and recognize the business impact and potential of E-Commerce.
- To explain the technologies required to make E-Commerce viable and gain knowledge about the current drivers and inhibitors facing the business world in adopting and using E-Commerce.
- To make them aware of the economic consequences of E-Commerce.

UNIT I INTRODUCTION**9**

Traditional commerce and Ecommerce - Categories of Electronic commerce – Business models – Revenue models – Business processes. Internet and WWW–role of WWW–value chains–strategic business – Revenue Strategy issues – Industry value chains - supply chain management–role of Ecommerce.

UNIT II INFRASTRUCTURE FOR E COMMERCE**9**

Packet switched networks–Routing packets. TCP/IP protocol script: IP Addressing – Domain names – E-mail protocols. Internet utility programs–SGML, HTML and XML–web client and servers–Web client/server architecture– intranet and extranets – Public and private networks – Virtual private network.

UNIT III WEB BASED TOOLS FOR E-COMMERCE**9**

Web server: Server computers –performance evaluation – Hardware architectures. Web server software feature sets–web server software and tools–Internet Utility programs – Data analysis software – Link checking utilities. web protocol–search engines–intelligent agents –EC software– webhosting–cost analysis.

UNIT IV SECURITY**9**

Computer security classification–copyright and Intellectual property–electronic commerce threats: Secrecy threats – Integrity threats – Necessity threats Encryption solutions. Protecting client computers– electronic payment systems– electronic cash–strategies for marketing–sales and promotion–cryptography – authentication.

UNITV INTELLIGENT AGENTS**9**

Definition and capabilities–limitation of agents – History of software agents – Characteristics and properties a of agents – Tele script Agent Language – safe-Tcl –security–web based marketing– search engines and Directory registration–online advertisements– Portable sand info mechanics–website design issues.

TOTAL: 45 Hours

TEXT BOOKS:

1. Ravi Kalakota, Andrew B. Whinston "frontiers of Electronic Commerce", Pearson Education, 2008.
2. Gary P Schneider "Electronic commerce", Thomson learning & James T Peny Cambridge USA, 2001.
3. Manlyn Greenstein and Miklos "Electronic commerce" McGraw-Hill, 2002.

REFERENCE BOOKS:

1. Efraim Turvan J. Lee, David Kugand chung, "Electronic commerce" Pearson Education Asia 2001.
2. Brenda Kienew Ecommerce Business Prentice Hall, 2001.

WEBLINKS:

1. https://www.iare.ac.in/sites/default/files/lecture_notes/IARE E-Commerce Lecture Notes.pdf
2. <https://www.techtarget.com/searchcio/definition/e-commerce>
3. <https://cyber.harvard.edu/olds/ecommerce/library.html>

COURSE OUTCOMES:

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

CO 1	Understand the advantages of ecommerce over traditional business	K2
CO 2	Illustrate various infrastructure approaches and techniques for E-business and management	K2
CO 3	Acquire knowledge on encryption solutions and cryptography	K2
CO 4	Identify the threats arising out of network and suggest corrective measures	K2
CO 5	Understand the role of agents in e-commerce and their limitations	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
C01	-	-	1	1	-	-	-	-	-	1	-	2	1	1
C02	1	-	2	2	2	-	-	-	-	1	-	2	2	2
C03	1	-	1	2	2	-	-	1	1	1	1	2	1	-
C04	1	1	2	2	2	-	-	2	1	2	-	2	3	-
C05	-	-	-	-	-	-	-	1	1	-	-	3	1	1
Average	1.0	1.0	1.5	1.8	2.0	-	-	1.3	1.0	1.7	1.0	2.2	1.6	1.3

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
	✓		✓	

SYLLABUS
OPEN ELECTIVE COURSES
(TECHNICAL)

22ECV154	GLOBAL WARMING AND CLIMATE CHANGE	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- To clearly understand the causes of global warming.
- To develop idea of weather and climate.
- To understand how the global warming have impacts on people and nature.
- To learn to save energy and to develop alternative sources of energy.

UNIT I EARTH'S CLIMATE SYSTEM 9

Role of ozone in environment-ozone layer-ozone depleting gases-Green House Effect, Radioactive Effects of Greenhouse Gases-The Hydrological Cycle-Green House Gases and Global Warming – Carbon Cycle.

UNIT II ATMOSPHERE AND ITS COMPONENTS 9

Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere- Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.

UNIT III IMPACTS OF CLIMATE CHANGE 9

Causes of Climate change : Change of Temperature in the environment-Melting of ice Pole-sea level rise- Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV	OBSERVED CHANGES AND ITS CAUSES	9
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Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol- Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India .

UNIT V	CLIMATE CHANGE AND MITIGATION MEASURES	9
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Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

TOTAL: 45 Hours

TEXT BOOKS:

1. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

REFERENCE BOOKS:

1. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
2. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

WEB LINKS:

1. <https://climate.nasa.gov/resources/global-warming-vs-climate-change/>
2. <https://www.nrdc.org/stories/global-warming-101>
3. <https://www.globalissues.org/article/233/climate-change-and-global-warming-introduction>

COURSE OUTCOMES:

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

CO 1	Understand the physical basis of natural greenhouse effect, carbon cycle and the hydrological cycle	K2
CO 2	Analyze the impact of climate change on the environment	K3
CO 3	Identify the irreversible losses and the extent of damage caused by these losses	K2
CO 4	Relate to the various protocols followed in India and world	K2
CO 5	Summarize the mitigation measures to be taken to handle the climate change	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
C01	1	-	-	-	-	3	2	-	-	-	-	3	1	-
C02	3	1	2	2	1	3	2	1	1	1	1	2	2	1
C03	2	-	3	2	-	3	3	2	1	2	3	3	3	1
C04	2	-	2	1	1	3	3	3	2	2	2	3	3	1
C05	2	1	3	2	1	3	3	2	2	1	1	2	2	1
Average	2.0	1.0	2.5	1.8	1.0	3.0	2.6	2.0	1.5	1.5	1.8	2.6	2.2	1.0

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓	✓			✓

COURSE OBJECTIVES:

- To identify the role of various modes of Mass Transportation like Bus and Rail and its Planning and Management
- To gain knowledge on various transit systems like bus, rail and air

UNIT I TRANSIT SYSTEM AND ISSUES**7**

Introduction to Mass Transport – Role of various modes of Mass Transport – Problems and their Impact – Transport System Performance at National, State, Local and International levels – National Transport Policy

UNIT II PUBLIC TRANSIT SYSTEM**9**

Urban Transport System – Public Transport System Re-genesis and Technology – Problems and issues faced by Public Transport System – Public Transport and Urban Development Strategies - Feeder Routes- IntermediatePublic Transport.

UNIT III URBAN RAIL TRANSIT**9**

Transit and Rail Tunnels- MRTS – LRTS, Metro Rail – Monorail – High speed trains- cable railway system for steep gradients- Tubular Rail-Tramways- Case Studies

UNIT IV AIRPORT AND AIR TRANSIT**10**

Planning of airports and its impact on metropolitan city development– Accessibility – Transport Connections – Road and Rail, Expansion – Feasibility Studies – Environmental and Social Issues – Forecasting Future Traffic – Airfield Capacity and Delay - Aircraft characteristics – Airport Site Selection

UNIT V IMPACT OF TRANSIT**10**

Policies and Strategies for Mass Transport – Need for Integrated Approach – Unified TransportAuthorities – Institutional arrangement – Urban Transport Fund – Parking Policies - Private Sector inMass Transport – Bus and Rail Integration – Co-ordination of Feeder Services – Transit OrientedLand Use Development – Case Studies - Urban Transportation and Land use – Impact of TransportDevelopment on Environment – Remedial measures – Policy Decisions – Recent Trends in MassTransportation Planning and Management

TOTAL: 45 Hours**TEXT BOOKS:**

1. C.J. Khisty and B.K. Lall, "Transportation Engineering – An Introduction", Prentice Hall of India Pvt. Ltd., 2002.
2. L.R. Kadiyali, "Traffic Engineering and Transport Planning, Khanna Publishers", New Delhi, 2000

REFERENCE BOOKS:

1. C. S. Papacostas and P. D. Prevedouros, "Transportation Engineering and Planning", Prentice Hall of India Pvt. Ltd., 2001
2. Michael J. Bruton, "An Introduction to Transportation Planning", Hutchinson, 1985
3. G. E. Gray and L. A. Hoel, "Public Transportation", Prentice Hall, New Jersey, 1992
4. Paul H. Wright, "Transportation Engineering – Planning and Design", John Wiley and Sons, New York, 1989.

WEBLINKS:

1. <https://www.intelligenttransport.com/transport-articles/21458/city-public-transportation-india/>
2. <https://www.government.nl/topics/mobility-public-transport-and-road-safety/public-transport/types-of-public-transport>
3. <https://www.statista.com/topics/8005/urban-public-transport-in-india/>

COURSE OUTCOMES:

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

CO 1	Relate to the problems faced in public transportation and summarize NTP	K2
CO 2	Understand the importance of planning strategies in mitigating the public bus transit	K2
CO 3	Compare the rail and air transit and infer the possibilities of implementing it in a city	K2
CO 4	Develop a framework for integrating various public transit systems	K3
CO 5	Relate to the policy changes and reduction in environmental damage due to the policy change	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
C01	1	1	1	1	1	3	2	1	1	1	-	3	2	-
C02	-	1	1	2	1	3	2	1	1	1	-	2	2	-
C03	-	1	2	2	1	3	3	2	1	2	-	3	2	1
C04	-	-	2	2	2	3	3	3	2	2	1	3	3	1
C05	1	1	1	2	-	3	3	2	1	1	-	2	2	-
Average	1.0	1.0	1.4	1.8	1.7	3.0	2.6	1.8	1.2	1.4	1.0	2.6	2.2	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
✓	✓			✓

REFERENCE BOOKS:

1. Gallian B. Arthur and Simon Eisner, "The Urban Pattern – City Planning and Design", Affiliated Press Pvt. Ltd., New Delhi, 1995.
2. Margaret Robert, "An Introduction to Town Planning Techniques", Hutchins London 1990.

WEBLINKS:

1. <https://k-render.com/7-basic-architectural-design-principles-every-architect-must-know/>
2. <https://pubs.opengroup.org/architecture/togaf8-doc/arch/chap29.html>
3. <https://ec.europa.eu/research/participants/documents/downloadPublic/NnN1c3dsRXZ4MnA1V21vdEjQTjVBekpDQ01iVUNsYUdKZ05KeHd6a2pWR2hyYlVOVitBaW5RPT0=/attachment/VFEyQTQ4M3ptUWQyTTErRGVPNjFQMHB6ZXhIUHNhcTQ=>

COURSE OUTCOMES:

CO 1	Understand about the integration of function and aesthetics in architecture	K2
CO 2	Understand the layout regulations and layout design concepts in site planning	K2
CO 3	Understand anthropometry and acquire knowledge on interior designing and safety regulations in buildings	K2
CO4	Design buildings such that it integrates climate and buildings with environment	K3
CO 5	Understand the concepts of urban standards for town planning and challenges to urbanization and population	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O 1	PS O 2
C01	1	1	1	1	1	3	2	-	1	1	-	3	2	-
C02	-	1	1	2	1	3	2	-	1	2	-	2	2	-
C03	1	1	2	2	1	3	3	-	1	2	-	3	2	-
C04	-	-	2	2	2	3	3	-	2	2	1	3	3	1
C05	1	1	1	2	-	3	3	-	1	1	-	2	2	-
Average	1.0	1.0	1.4	1.8	1.3	3.0	2.6	-	1.2	1.6	1.0	2.6	2.2	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
				✓

COURSE OBJECTIVES

- This subject covers the sources, characteristics and effects of air and noise pollution and the methods of controlling the same
- The student is expected to know about source inventory and control mechanism

UNIT I SOURCES AND EFFECTS OF AIR POLLUTANTS 9

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution –Source inventory – Effects of air pollution on human beings, materials, vegetation, animals –global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling –Source and ambient sampling – Analysis of pollutants – Principles.

UNIT II DISPERSION OF POLLUTANTS 9

Fundamentals of meteorology – Wind roses – Atmospheric stability Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

UNIT III AIR POLLUTION CONTROL 9

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

UNIT IV AIR QUALITY MANAGEMENT 9

Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts– Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality

UNIT V NOISE POLLUTION 9

Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices.

TOTAL: 45 Hours**TEXT BOOKS:**

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.

3. Rao M.N. and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996.

REFERENCE BOOKS:

1. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New York, 1997.
2. Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi
3. Mahajan, S.P., "Pollution Control in Process Industries", Tata McGraw-Hill, New Delhi, 1991

WEBLINKS:

1. <https://byjus.com/biology/air-pollution-control/>
2. https://www.researchgate.net/publication/327136390_AIR_POLLUTION_MANAGEMENT
3. https://www.researchgate.net/publication/279202084_Causes_Consequences_and_Control_of_Air_Pollution

COURSE OUTCOME:

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

CO 1	Understand the structure and composition of atmosphere, sources, effects and classification of air pollutants	K2
CO 2	Draw a windrose diagram for dispersion of pollutants	K3
CO 3	Interpret the various air pollution control measures	K2
CO 4	Understand the concepts of air quality management and air quality legislations	K2
CO 5	Identify the appropriate noise instrumentation and monitoring procedure for various noises	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
C01	2	1	1	1	1	3	2	-	1	1	-	3	1	-
C02	1	2	2	2	2	3	2	-	1	2	-	2	2	-
C03	1	-	1	2	1	2	1	-	1	1	-	3	2	-
C04	-	-	-	1	-	2	2	-	1	1	1	3	2	1
C05	1	-	1	1	-	1	-	-	1	1	-	2	2	-
Average	1.3	1.5	1.3	1.4	1.3	2.2	1.8	-	1.0	1.2	1.0	2.6	1.8	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
				✓

COURSE OBJECTIVES

- To protect the rights of the University, its innovators, inventors, research sponsors and the public
- To eliminate the infringement, improper exploitation and abuse of the University's intellectual assets belonging to the University or the other persons
- To optimize the environment and incentives for research and for the creation of new knowledge

UNIT I INTRODUCTION 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Need for IPR- Protection of IPR -IPR in India – Genesis and Development IPR in abroad - some important examples of IPR – Basic types of property: Movable Property - Immovable Property and - Intellectual Property- Competing Rationales for Protection of Intellectual Property Rights

UNIT II APPLICATIONS OF IP 9

IP – Patents-Procedure for Opposition- Revocation of Patents - Ownership and Maintenance of Patents- Assignment and licensing of Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits –Protection of Geographical Indications at national and International levels – Application Procedures -

UNIT III IP ESSENTIALS 9

International convention relating to Intellectual Property – Establishment of WIPO –Mission and Activities – History – General Agreement on Trade and Tariff (GATT) –TRIPS Agreement-Copyright and Related Rights- Trademarks - Geographical Indications - Industrial Designs - Layout-Designs (Topographies) of Integrated Circuits - Protection of Undisclosed-The text of the TRIPS Agreement.

UNIT IV GLOBAL PERSPECTIVE 9

Indian Position Vs WTO and Strategies – Economics of intellectual property-Other intellectual property conventions -Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy –Present against unfair competition-TRIPS work in the WTO - WTO bodies - IPR Enforcement - Global Value of Digital Piracy.

UNIT V TRENDS IN IP 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications– Protection against unfair competition- India's IP regime –Development- Legislation- International Searching Authority and International Preliminary Examining Authority- IPR on Internet.

TEXT BOOKS:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. 3rd Edition 2006.

REFERENCE BOOKS:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.

WEBLINKS

- <https://ipindia.gov.in/patents.htm>
- [https://uk.practicallaw.thomsonreuters.com/0-610-9089?transitionType=Default&contextData=\(sc.Default\)&firstPage=true](https://uk.practicallaw.thomsonreuters.com/0-610-9089?transitionType=Default&contextData=(sc.Default)&firstPage=true)
- <https://kapila.mic.gov.in/>

COURSE OUTCOMES:

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

CO 1	Understand the assets that fall under Intellectual property rights	K2
CO 2	Interpret the different terms under intellectual property rights like patents, trademarks etc	K2
CO 3	Understand the IP essentials and TRIPS agreement	K2
CO 4	Infer the protection under WTO patent ordinance	K2
CO 5	Acquire knowledge on Indian IP regime and process of examining the patents	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS 01	PS 02
CO1	-	-	-	-	-	-	-	3	1	1	-	3	2	-
CO2	-	-	-	-	-	-	-	3	1	1	-	2	2	-
CO3	-	-	-	-	-	-	-	3	1	1	-	3	2	-
CO4	-	-	-	-	-	-	-	3	1	1	1	3	2	1
CO5	-	-	-	-	-	-	-	3	1	1	-	3	2	-
Average	-	-	-	-	-	-	-	3.0	1.0	1.0	1.0	2.8	2.0	1.0

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✓	

22ECV159	PRINCIPLES OF MANAGEMENT & PROFESSIONAL ETHICS	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations.
- After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling.
- Students will also gain some basic knowledge on international aspect of management.

UNIT I OVERVIEW OF MANAGEMENT 9

Definition - Management - Role of managers - Evolution of Management thought – Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.

UNIT II PLANNING & ORGANIZING 9

Nature and purpose of planning and Organizing - Planning process - Types of plans – Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions. - Organization structure - Formal and informal groups I organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - Performance Appraisal.

UNIT III DIRECTING & CONTROLLING 9

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication – Organization Culture - Elements and types of culture - Managing cultural diversity. Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

UNIT IV ENGINEERING ETHICS & HUMAN VALUES 9

Definition - Societies for engineers – Code of Ethics – Ethical Issues involved in cross border research - Ethical and Unethical practices – case studies – situational decision making - 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 V SAFETY RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime –

Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination – Global issues
 - Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –
 Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral
 Leadership – Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 Hours

TEXT BOOKS:

1. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall of India, 8th edition, 2010.
2. Charles W L Hill, Steven L McShane, "Principles of Management", Mcgraw Hill Education, Special Indian Edition, 2007.
3. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2005.

REFERENCE BOOKS:

1. Hellriegel, Slocum & Jackson, "Management - A Competency Based Approach", Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, "Management - A global & Entrepreneurial Perspective", Tata McGraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, "Essentials of Management", Thomson Southwestern, 7th edition, 2011.
4. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.

WEBLINKS:

1. <https://www.iaa.govt.nz/for-advisers/adviser-tools/ethics-toolkit/professional-ethics-and-codes-of-conduct/>
2. <https://ethics.iit.edu/teaching/professional-ethics>
3. <https://www.toolshero.com/management/14-principles-of-management/>
4. https://www.managementstudyguide.com/management_principles.htm

COURSE OUTCOMES:

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

CO 1	Understand the planning and organizing system of the management	K2
CO 2	Infer the management framework of a company	K2
CO 3	Understand the direction and controlling system of the management	K2
CO 4	Identify and analyze the ethical issue in the subject matter under investigation	K2
CO 5	Identify the multiple ethical interests at stake in a real-world situation or in social context problems	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
C01	-	-	-	-	-	-	-	-	2	1	-	3	2	-
C02	-	-	-	-	-	-	-	-	3	1	-	2	2	-
C03	-	-	-	-	-	-	-	-	3	1	-	3	2	-
C04	-	-	-	-	-	-	-	3	2	1	1	3	2	-
C05	-	-	-	-	-	-	-	3	2	1	-	3	2	-
Average	-	-	-	-	-	-	-	3.0	2.4	1.0	1.0	2.8	2.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
				✓

22ECV160	ROLE OF CITIZENS IN ENVIRONMENT CONSERVATION	L	T	P	Credits
		3	0	0	3

COURSE OBJECTIVES

- To develop capacity to meet emergencies and natural disasters
- To practice reduce, recycle and reuse for environment conservation

UNIT I ENVIRONMENT ISSUES 12

Environment conservation, enrichment and Sustainability- Climate change- Waste management- Natural resource management- (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).

UNIT II DISASTER MANAGEMENT 6

Introduction to Disaster Management, classification of disasters- Role of youth in Disaster Management

UNIT III PROJECT CYCLE MANAGEMENT 9

Project Planning- Project Implementation - Project Monitoring-Project Evaluation: impact assessment

UNIT IV DOCUMENTATION AND REPORTING 6

Collection and analysis of data- Preparation of documentation/reports- Dissemination of documents/reports

UNIT V STORAGE, COLLECTION AND TRANSPORT OF WASTES 12

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport

TOTAL: 45 Hours

TEXT BOOKS:

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill International edition, New York, 1993.

REFERENCE BOOKS:

1. National Service Scheme Manual, Govt. of India.
2. Training Programme on National Prgoramme scheme, TISS.
3. Ram Ahuja, "Social Problems in India", Second edition, Rawat Publication, New Delhi, 1992.

WEBLINKS:

1. https://www.researchgate.net/publication/226482350_Role_of_Citizens_in_Environmental_Conservation_The_Case_of_the_Yokosuka_City_A_Statistical_Analysis
2. <https://link.springer.com/article/10.1007/s11115-009-0086-7>
3. https://www.enviro-lawyer.com/The_Role_of_the_Citizen_in_Environmental_Enforcement.pdf
4. <https://citizenmatters.in/tips-from-a-citizen-for-environment-sustainability-reduce-reuse-recycle-5567>

COURSE OUTCOMES:

C01	Understand the implementation of environmental conservation techniques such as therain water harvesting, energy conservation, waste land development and afforestation	K2
C02	Create awareness about disaster management and mitigation methods in the society	K3
C03	Realize the importance of the role of youth in project management and implementation of societal activities	K2
C04	Infer knowledge on data analysis and collection and learn about project monitoring and dissemination of reports	K2
C05	Understand the need for concern for environment, disaster management and waste management in the current scenario with respect to global circumstances	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
C01	1	2	1	1	-	3	3	-	2	1	-	3	2	-
C02	-	-	1	1	1	3	2	-	3	3	-	2	2	-
C03	-	-	-	-	-	3	1	-	2	2	-	3	-	-
C04	1	2	1	1	1	3	2	3	2	1	1	3	2	-
C05	1	1	-	1	-	3	3	3	2	-	-	3	2	-
Average	1.0	1.7	1.0	1.0	1.0	3.0	2.2	3.0	2.2	1.8	1.0	2.8	2.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✓	✓	✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
		✓	✓	

SYLLABUS

EMPLOYMENT ENHANCEMENT COURSES

22CPD201	PERSONALITY DEVELOPMENT I	L	T	P	Credits
		2	0	0	2

COURSE OBJECTIVES:

- To nurture and develop winning personalities and eventually leading them to become dynamic and socially responsible leaders

UNIT I	SOFT SKILLS I	6
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Introduction to Personality Development – Meaning–Features of personality – Dimensions of Personality
Determinants of Personality–Features and Traits– Components of self concept–Barriers–Self analysis

UNIT II	SOFT SKILLS II	6
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Importance of Soft Skills – First impression–Work Place requirements–Discipline –Cleanliness Hygiene – general Appearance--Building Confidence—Concept of Thinking and Usage –Value of Time–Focus & Commitment.

UNIT III	SOFT SKILLS IN ACTION	6
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Grooming – Attire – Understanding others– Stability & Maturity Development – Strength s – Weakness – Opportunities–threats – Merits of SWOT Analysis – Components – how to convert weakness into strengths – Goal settings

UNIT IV	SELF AWARENESS AND SELF ESTEEM	6
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Definitions – Components of Self awareness – Developing Self awareness – Self esteem – meaning –Steps to improve self esteem.

UNIT V	SELF MOTIVATION	6
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Motivation – Meaning –Techniques of self motivation–Motivation & goal setting – Motivation and emotion
– Motivation at work.

TOTAL: 30 Hours

TEXT BOOKS:

1. Personality Development And Soft Skills Barun K Mitra, Oxford Publication
2. Seven habits of Highly Effective people – Stephen R. Covey

REFERENCE BOOKS:

1. Emotion, motivation and Self regulation – Nathan C. Hall, McGill University, Canada Thomas Goetz, University of Konstanz, Germany <http://www.emeraldgroupublishing.com>.
2. Psychology of Self esteem – Nathaniel Branden, Nash (1st edition), Jossey – Bass (32 nd anniversary edition)

WEBLINKS:

- <https://www.educations.com/articles-and-advice/soft-skills-you-need-to-get-ahead-14193>

COURSE OUTCOMES

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

C01:	Discuss the features, dimensions and determinants of personality	K2
C02:	Make a good first impression in professional and other situations	K3
C03:	Demonstrate confidence, punctuality and commitment as an engineer	K3
C04:	Set goals for development using SWOT analysis	K5
C05:	Develop self-awareness and improve self esteem	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
C01	-	-	-	-	-	-	-	-	2	2	-	3	2	-
C02	-	-	-	-	-	-	-	-	3	3	-	3	2	-
C03	-	-	-	-	-	-	-	-	2	2	-	3	-	-
C04	-	-	-	-	-	-	-	1	2	2	-	3	2	-
C05	-	-	-	-	-	-	-	1	2	2	-	3	2	-
Average	-	-	-	-	-	-	-	1.0	2.2	2.2	-	3.0	2.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓	✓	✓	✓	✓	

22CPD202

PERSONALITY DEVELOPMENT II

L	T	P	Credits
2	0	0	2

COURSE OBJECTIVES:

- To improve leadership quality by understanding the various etiquettes.
- To inculcate the need to continuously develop analytical and logical skills.

UNIT I SOFT SKILLS III 6

Basic Etiquette – Email etiquette – Business etiquette – Telephone etiquette – Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development

UNIT II QUANTITATIVE APTITUDE I 6

Percentage – Profit Loss –Discount – Ratio Proportion – Time & Work – Time, Speed & Distance. Problems relating to ages– Permutation & Combination–Probability

UNIT III QUANTITATIVE APTITUDE II 6

Mensuration – Clocks and Calendars – Boats – Simple Interest – Compound Interest – Fractions and Decimals – Square roots – Functions.

UNIT IV ANALYTICAL PROBLEMS 6

Introduction – Linear Sequencing – Seating Arrangements – Distribution/Double Line Up – Selection – Ordering and Sequencing – Binary Logic – Venn Diagrams –Directions.

UNIT V LOGICAL PROBLEMS 6

Introduction to Logical problems – Cause and Effect – Course of Action – Statement and Assumption – Letter and Symbol series – Analogies.

TOTAL: 45Hours

TEXT BOOKS:

- T1. K. R. Dhanalakshmi and N S Raghunathan, Personality Enrichment, Margham Publications, 2012
T2. R. S. Agarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publishers, 2017

REFERENCE BOOKS:

- R1. D. P. Sabharwal, Personality Development Handbook, Fingerprint publishing, 2021
R2. A.K Gupta, Logical and Analytical Reasoning (English), Ramesh Publishing House, 2022

WEBLINKS:

- <https://www.talentlyft.com/en/resources/what-is-aptitude-and-ability-tests>
- <https://www.zippia.com/advice/logical-thinking-skills/>

➤ <https://www.cleverism.com/skills-and-tools/logical-thinking/>

COURSE OUTCOMES

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

C01:	Discuss the basic, email, business, telephone and meeting etiquettes.	K2
C02:	Solve problems on ratio proportion related to profit and loss, discounts, time and work, Time, speed and distance.	K3
C03:	Work with fractions, decimals and square roots.	K3
C04:	Analyze the cause, effect and course of action in logical problems.	K4
C05:	Solve problems on the letter and symbol series.	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS 01	PS 02
C01	-	-	-	-	-	-	-	-	2	2	-	3	2	-
C02	3	2	2	1	1	-	-	-	3	1	-	3	2	-
C03	3	2	1	1	1	-	-	-	2	2	-	3	2	-
C04	3	2	1	1	1	-	-	-	2	2	-	3	2	-
C05	3	3	1	1	1	-	-	-	2	2	-	3	2	-
Average	3.0	2.3	1.3	1.0	1.0	-	-	-	2.2	1.8	-	3.0	2.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓	✓	✓	✓	✓	

COURSE OBJECTIVE:

- To enhance the communication, interpersonal, group skills.

UNIT I VERBAL APPTITUDE I**6**

Phonetics / Neutral Accent / Pronunciation – Speech Mechanism / Mouth & Face Exercise – Vowels & Consonants – Sounds – Syllable and Syllable Stress/ Word Stress – Sentence Stress & Intonation Articulation Exercise – Rate of Speech / Flow of Speech / Idiomatic Phrases.

UNIT II VERBAL APTITUDE II**6**

Singular/plural – present tense / past tense – genders Prepositions – conjunctions – Choice of words – simple sentences – compound sentences – summarizing phrases Synonyms – Antonyms – Analogies – Similar Words.

UNIT III SOFT SKILLS**6**

Attitude – Meaning–Features of attitude – Formation – Personality Factors –Types of attitude – change in attitude – developing Positive attitude.

UNIT IV TIME MANAGEMENT**6**

Definition – Meaning–Importance, Value of time as an important resource – comparison of Time and Money – Circle of influence and circle of control – Definition of URGENT and IMPORTANT – Time Wasters and how to reduce – Procrastination – meaning and impact – 4 Quadrants.

UNIT V TEAM BUILDING**6**

Meaning – Aspects of team building – Process of team building – Types of Teams – Team Ethics and Understanding – Team trust and commitment.

TOTAL: 30 Hours**TEXT BOOKS:**

- T1. B N Ghosh, Managing Soft Skills and Personality, Mc graw Hill Publications
- T2. Shejwalkar and Ghanekar, Principles and Practices of Management, Mc Graw Hill Latest.
- T3. Roberta Roesch, Time management for Busy people, Tata McGraw–Hill Edition

REFERENCE BOOKS:

- R1. D. P. Sabharwal, Personality Development Handbook, Fingerprint publishing, 2021
- R2. Dr V M Selvaraj, Personality Development, Bhavani Publications

WEBLINKS:

- <https://www.thebalancecareers.com/list-of-soft-skills-2063770>
- <https://www.investopedia.com/terms/s/soft-skills.asp>
- <https://in.indeed.com/career-advice/resumes-cover-letters/soft-skills>

COURSE OUTCOMES

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

C01:	Articulate by understanding the rate and flow of speech.	K3
C02:	Choose words and phrases appropriately for any verbal communication.	K3
C03:	Develop a positive attitude in handling diverse situations.	K4
C04:	Prioritize important and urgent tasks using the four quadrants method.	K4
C05:	Practice team ethics and understanding when working with teams.	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS 0 1	PS 0 2
C01	-	-	-	-	-	-	-	-	3	3	-	3	3	-
C02	-	-	-	-	-	-	-	-	3	3	-	3	2	-
C03	-	-	-	-	-	-	-	-	3	3	-	3	3	-
C04	-	-	-	-	-	-	-	-	3	3	-	3	2	-
C05	-	-	-	-	-	-	-	3	3	3	-	3	2	-
Average	-	-	-	-	-	-	-	3.0	3.0	3.0	-	3.0	2.4	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓	✓	✓	✓	✓	

COURSE OBJECTIVES:

- To enhance the soft skills and prepare them towards the skills needed for their career.

UNIT I SOFT SKILLS**6**

Assertiveness – Meaning – Importance of assertiveness – Characteristics of Assertive communication – Merits – forms of assertion – Causes of misunderstanding

UNIT II COMMUNICATION SKILLS**6**

Meaning – Elements of Communication – Functions of Communication – Principles of Communication Formal and Informal Communication – Barriers in Communication – Characteristics of good – communication – Feedback – Communication systems.

UNIT III PRESENTATION SKILLS**6**

Meaning – Importance of Presentation – Concept of 5 W's and one H – understanding the audience – Types of presentations – How to make effective presentation.

UNIT IV PRESENTATION SKILLS II**6**

Use of slide, PPT's and visuals – Rules for slide presentation – precautions – seminars and conferences – Steps to eliminate Stage fear.

UNIT V CHANGE MANAGEMENT**6**

Definition – Necessity – Resistance towards Change – 10 Principles of Change Management – Leaders approach – Effective Change management.

TOTAL: 30 Hours**TEXT BOOKS:**

- T1. LaClair, J. and Rao, R. Helping Employees Embrace Change, McKinsey Quarterly, 2002, Number 4.
- T2. Spencer Johnson, Who Moved My Cheese, Vermilion, First edition
- T3. Adair, John, Effective Communication, London: Pan Macmillan Ltd., 2003.

REFERENCE BOOKS:

- R1. Bovee, Courtland L, John V. Thill & Barbara E. Schatzman. Business Communication Today, Tenth Edition. New Jersey: Prentice Hall, 2010.

WEBLINKS:

- <https://www.thebalancecareers.com/communication-skills-list-2063779>
- <https://www.mindtools.com/page8.html>

COURSE OUTCOMES

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

C01:	Be assertive in their communication.	K3
C02:	Differentiate the principles of formal and informal communication.	K4
C03:	Make an effective presentation by understanding the audience.	K3
C04:	Practice the rules of presentation using slides, PPT's and visuals.	K3
C05:	Discuss the principles of change management.	K2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
C01	-	-	-	-	-	-	-	-	2	3	-	3	3	-
C02	-	-	-	-	-	-	-	-	2	3	-	3	3	-
C03	-	-	-	-	-	-	-	-	2	3	-	3	3	-
C04	-	-	-	-	-	-	-	-	2	3	-	3	3	-
C05	-	-	-	-	-	-	-	-	2	3	-	3	3	-
Average	-	-	-	-	-	-	-	-	2.0	3.0	-	3.0	3.0	-

ASSESSMENT METHODS

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓
Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✓	✓	✓	✓	✓	