Course Title	Course code	Name of the programme	Activities with direct bearing on employability/Entrepreneurship/Skill development	Year of Introduction
Surveying Camp	CE-556	B-Tech	Field practices in surveying	2017

Course Outcomes of Surveying CampCE-556

CO1	To learn to work as team, ethics and prepare technical reports of surveying.
CO2	To relate theoretical knowledge of surveying to resolve real field problems.
CO3	To establish horizontal control and vertical control by traversing and triangulation.
CO4	To prepare topographical map and contour map on an area.

Mapping of POs with Cos

Programme Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			2		2	2	2	3	3	2	2	1
CO2	2	3	3		3			2			2	
CO3	3	3		3	2							1
CO4		3		3	2							1

1 Indicates weak relationship.

2 Indicates moderate relationship.

3 Indicates strong relationship.

Course Title	Course code	Name of the programme	Activities with direct bearing on employability/Entrepreneurship/Skill development	Year of Introduction

Engineering economy & const. Management	CE 764	B-Tech	Software Practices	2017

Course Outcomes (**CE 455/764)**

CO1	To be able to use a number of Excel functions for economic evaluation of engineering project proposals using accepted economic analysis techniques.
CO2	To be able to prepare WBS, identify activities, estimate duration of activities, to be able to understand and establish relationship between activities and to be able to calculate resources required for activities for a civil engineering project.
CO3	To be able to understand the structure and application of Primavera software for preparation of schedule of a civil engineering project
CO4	To be able to prepare schedule of a live civil engineering project using Primavera software.

Mapping of POs with Cos

Programme Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	3	1	1	1	1	3	3	1
CO2	3	3	3	1	3	1	1	1	1	3	3	3
CO3	3	3	3	1	3	1	1	1	3	3	3	3
CO4	3	3	3	1	3	1	2	1	3	3	3	3

Course Title	Course code	Name of the programme	Activities with direct bearing on employability/Entrepreneurship/Skill development	Year of Introduction
Design of steel structure lab	CE-653	B-Tech	Design of real world structures	2017

Course Outcomes CE-653

CO1	Detailing of simple and bracket connections (Lap joint & Butt joint)
CO2	Detailing of tension members, lug angles.
CO3	Detailing of compression members laced and battened columns.
CO4	Detailing of column bases & footing.
CO5	Detailing of flexure members: Beams - rolled sections, built-up sections.

Mapping of POs with COs

Programme Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2											
CO2	2											
CO3	3		3									
CO4	3		3									
CO5	3		2									

Course Title	**Course code**	**Name of the programme**	**Activities with direct bearing on employability/Entrepreneurship/Skill development**	**Year of Introduction**
Design of structure lab III	**CE-752**	**B-Tech**	**Design of real world structures**	**2017**

Course Outcomes CE-752

CO1	Able to analyse & Detail the reinforcement for Two way slab.
CO2	Able to analyse & Detail the columns reinforcement as per IS-456 (2000)

CO3	Able to analyse & Detail of different types of staircase with its structural behaviour.
CO4	Detailing of roof truss with connection& detailing of Gantry Girder.

Mapping of POs with COs

Programme Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2											
CO2	2											
CO3	3		3									
CO4	3		3									
CO5	3		2									

Course Title	**Course code**	**Name of the programme**	**Activities with direct bearing on employability/Entrepreneurship/Skill development**	**Year of Introduction**
Soil Mechanics Lab	**CE-554**	**B-Tech**	**Field soil tests**	**2017**

Course Outcomes CE-554

CO1	Work ethically in diverse teams under multidisciplinary environment.
CO2	Develop leadership and communication skills, and engage in life-long leaning.
CO3	Determine properties of soils using data obtained from lab/ field tests.
CO4	Use the properties of soil determined from experiments.

Mapping of POs with COs

Programme Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								3	3			
CO2									3	3	3	3
CO3	2	1		3	2	2	2	2		3	3	3
CO4	2	1		3	2	2	2	2		2	2	3

Course Title	Course code	Name of the programme	Activities with direct bearing on employability/Entrepreneurship/Skill development	Year of Introduction
Transportation Engineering Lab	CE-652	B-Tech	Field tests on bitumen, aggregate and traffic engineering data collection and analysis	2017

Course Outcomes CE-652

CO1	Work ethically in diverse teams under multidisciplinary environment.
CO2	Develop leadership and communication skills, and engage in life-long leaning.
CO3	Develop and interpret experimental data obtained from the lab testing on highway materials.
CO4	Collect traffic data and analyse it.

Mapping of POs with COs

Programme Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								3	3			
CO2									3	3	3	3
CO3	2	1		3	2	2	2	2		3	3	3
CO4	2	1		3	2	2	2	2		2	2	3

Course Title	Course code	Name of the programme	Activities with direct bearing on employability/Entrepreneurship/Skill development	Year of Introduction
Summer Training Practical	CE-757	B-Tech	Field exposure	2017

Course Outcomes CE-767

CO1	Underline the various civil engineering activities being carried out in the field.
CO2	Recall the concept of planning and designing to a typical civil engineering project.
CO3	Practice the theory and practice required to analyse and design of typical civil engineering project.
CO4	Function well in projects that involve team members who represent multi-disciplinary fields on wide range of subjects.
CO5	Practice civil engineering tasks and make decisions ethically and professionally with consideration of social and global implications
CO6	Communicate effectively in both oral and written forms with different types of audiences on various topics.
CO7	Apply civil engineering codes of practice, specifications and testing standards to evaluate and select suitable construction.
CO8	Demonstrate the use of techniques, skills, and modern engineering tools necessary for engineering practice.

Course Title	Course code	Name of the programme	Activities with direct bearing on employability/Entrepreneurship/Skill development	Year of Introduction
Minor	CE-760	B-Tech	Solving real world problems	2017

Project				

Course Outcomes of Minor Project CE-760

CO1	Identify, analyse and formulate the Civil Engineering Problems
CO2	Apply the concept of planning and designing to a typical civil engineering project.
CO3	Apply the theory and practices learnt to analyse and design of typical civil engineering project and propose the solutions
CO4	Perform well in projects that involve team members who represent multi-disciplinary fields on wide range of subjects.
CO5	Execute civil engineering tasks and make decisions ethically and professionally with consideration of social and global implications
CO6	Communicate effectively in both oral and written forms with different types of audiences on various topics.
CO7	Apply civil engineering codes of practice, specifications and testing standards to evaluate and select suitable construction.
CO8	Apply the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Title	Course code	Name of the programme	Activities with direct bearing on employability/Entrepreneurship/Skill development	Year of Introduction
Major Project	**CE-860**	**B-Tech**	**Solving real world problems**	**2017**

Course Outcomes (CE-860)

CO1	Illustrate the concept of planning and designing typical civil engineering project.
CO2	Apply the theory and practice required to analyse and design of typical civil engineering

	project.
CO3	Function well in projects that involve team members who represent multi-disciplinary fields on wide range of subjects.
CO4	Execute civil engineering tasks and make decisions ethically and professionally with consideration of social and global implications.
CO5	Communicate effectively in both oral and written forms with different types of audiences on various topics.
CO6	Participate actively in professional activities and appreciate the engagement in life-long learning.
CO7	Apply civil engineering codes of practice, specifications and testing standards to evaluate and select suitable construction.
CO8	Apply the techniques, skills, and modern engineering tools necessary for engineering practice.

Structure of Curriculum for 2015 scheme

Semester I

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
AS-101	Communication Skills	3	--	--		3
AS-151	Language Lab	--	--	2		1
AS-102	Engineering Physics - I	2	1	--		3
AS-152	Engineering Physics Lab. - I	--	--	2		1
AS-103	Engineering Chemistry - I	2	1	--		3
AS-153	Engineering Chemistry Lab. - I	--	--	2		1
AS-104	Engineering Maths - I	3	1	--		4
CE-101	Basics of Civil Engineering	2	1	--		3
ME-101	Basics of Mechanical Engineering	2	1	--		3
EE-101	Basics of Electrical Engineering	2	1	--		3
ME-151	Workshop	--	--	4		2
AS-101	Communication Skills	3	--	--		3
AS-151	Language Lab	--	--	2		1

Semester II

AS-202	Engineering Physics - II	2	1	--		3
AS-252	Physics Lab. - II	--	--	2		1
AS-203	Engineering Chemistry - II	2	1	--		3
AS-253	Chemistry Lab. - II	--	--	2		1
AS-204	Engineering Maths. - II	3	1	--		4
AS-205	Innovative Sciences & Technology	2	1	--		4
EC-101	Basics of Electronics and Comm.	2	1	--		3
CS-101	Fundamentals of Computing	1	1	--		3
ME-250	Engineering Graphics	--	--	4		2

Semester III

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-301	Fluid Mechanics	3	1	-		4
CE-351	Fluid Mechanics Lab.	-	-	2		2
CE-302	Solid Mechanics	3	1	-		4
CE-352	Solid Mechanics Lab.	-	-	2		2
CE-303	Engineering Geology	4	-	-		4
CE-353	Engineering Geology lab.	-	-	2		2
CE-304	Civil Engineering Materials	4	-	-		4
CE-354	Civil Engineering Materials Lab.	-	-	2		2
CE-305	Numerical Methods	3	1	-		4

Semester IV

CE-401	Structural Analysis - I	3	1	-		4
CE-451	Structural Analysis Lab. - I	-	-	2		2
CE-402	Hydraulics	3	1	-		4
CE-452	Hydraulics lab.	-	-	2		2
CE-403	Building Construction	4	-	-		4
CE-404	Estimating and Costing	3	1	-		4
CE-454	Civil Engineering Drawing	-	-	2		2
CE-405	Surveying	3	1	-		4
CE-455	Surveying Lab.	-	-	2		2

Semester V

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-501	Structural Analysis-II	3	1	-		4
CE-502	Design of Concrete Structures	3	1	-		4
CE-552	Design of Concrete Structure Lab.	-	-	2		2
CE-503	Open Channel Flow	3	1	-		4
CE-504	Geotechnical Engineering	3	1	-		4
CE-554	Geotechnical Engineering Lab	-	-	2		2
CE-505	Environmental Engineering - I	3	1	-		4
CE-555	Environmental Engineering Lab-I	-	-	2		2
CE-556	Surveying Camp	-	-	2		2

Semester VI

CE-601	Advanced Structural Analysis	3	1	-		4
CE-602	Transportation Engineering	3	1	-		4
CE-652	Transportation Engineering Lab.			2		2
CE-603	Design of Steel Structures	3	1	-		4
CE-653	Design of Steel Structures Lab			2		2
CE-604	Hydrology	3	1	-		4
CE-605	Environmental Engineering - II	3	1	-		4
CE-655	Environmental Engineering La -II	-	-	2		2

Semester VII

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-701	Foundation Engineering	3	1	-		4
CE-702	Design of Structures	3	1	-		4
CE-752	Design of Structures Lab.	-	-	2		2
CE-703	Water Resources Engineering	3	1	-		4
CE-704	Engineering Economics & Construction Management	4	-	-		4
CE-754	Construction Management Lab	-	-	2		2
CE-711	Elective - I	4	-	-		4
CE-756	Summer Practical Training	-	-	-		2
CE-755	Minor Project	-	-	4		4

Semester VIII

CE-801	Irrigation Engineering	3	1	-		4
CE-811	Elective – II	4	-	-		4
CE-812	Elective – III	4	-	-		4
CE-813	Project	-	-	4		8
Total		119	33	60	0	211

BACHELOR OF TECHNOLOGY

(B. TECH.)

Civil Engineering

SYLLABUS

(CBCS)

Effective From

2015-16

Department of Civil Engineering
Faculty of Engineering & Technology
Jamia Millia Islamia
New Delhi-110025
www.jmi.ac.in

SYLLABUS

OF

BACHELOR OF TECHNOLOGY

(B. TECH.)

Effective From

2015-16

Department of Civil Engineering
Faculty of Engineering & Technology
Jamia Millia Islamia
New Delhi-110025

PREFACE

The revision and modification of the syllabus is a continuous process. The department was established in 1985 and a workshop of prominent engineers and educational list was held to develop the curriculum for the B-Tech in Civil engineering. The syllabus was later modified and published in the printed form in 1993. Since then a number of revisions have taken place both in the course structure and course content keeping in view the current trends in civil engineering education and demands of the industry. Recently, Jamia has introduced the Choice Based Credit System (CBCS) to all of its UG and PG courses. In this context, the latest version of the course structure and syllabus has been to incorporate the CBCS. This syllabus is an outcome of a thorough revision of course structure and course content with inputs from subject experts and professionals. The syllabus has been designed to provide a solid foundation in the core areas of civil engineering namely; structural engineering, geo-technical engineering, environmental engineering, water resources engineering, civil engineering materials, transportation engineering, surveying and GIS and construction management keeping in view the latest developments in these subject areas. I wish to acknowledge the hard work put in by the faculty members and stakeholders in the updating and revision of syllabus. I also wish to convey my sincere thanks to the subject experts who gave their valuable inputs in finalizing this syllabus.

(Mohammad Shakeel)
HOD, Civil Engineering

Department of Civil Engineering: a brief overview

The Department of Civil Engineering is one of the oldest and the largest department in the Faculty of Engineering & Technology. The department has produced several eminent engineers who have made important contributions in the planning and execution of many important Civil Engineering projects in India as well as abroad.

The Department offers two undergraduate courses in Civil Engineering. The Department also offers Master's programme with specialisations in Environmental Engineering and Earthquake Engineering. These courses are supported with strong doctoral programmes in all the major specialisations of Civil Engineering. The Department is known for its reputed faculty with expertise in diverse fields. Presently, the department has 22 highly qualified, experienced, sincere and dedicated faculty members, actively participating in research and consultancy work.

The Department has established a state of the art experimental facilities and laboratories in different fields of Civil Engineering. It has received the prestigious funding under FIST from DST and SAP from UGC.

The faculty also renders technical advice on live engineering problems to various Government and Private Sector companies throughout the country. These live projects are effectively used as training desk for our students at undergraduate and postgraduate levels. RITES, Military Engineering Services, Municipal Corporations of Delhi, Faridabad, Gurgaon, Gaziabad, NOIDA, PWD, CPWD, DDA, HUDA, Jal Nigam etc. regularly hire services for technical advice and vetting of designs of infrastructure projects.

International and national conferences, seminars and special lectures are a regular feature of the Department to impart education and training. The Department has active collaboration with academics and industry such as University of Applied Sciences Erfurt (Germany), Wessex Institute (UK), University of Waterloo (Canada), Asian Institute of Technology (Bangkok) and Steel Authority of India (INDIA).

Leading MNCs and public sectors are regular recruiter of our students and many students have been selected in Engineering Services. Large numbers of students qualify the GATE examination with good ranks to go for higher studies. Several of our alumni pursued higher education in foreign countries like USA, UK, Germany, Canada, Australia and France and have been appointed as faculty members and consultants abroad.The Department strongly believes in continuous efforts to strive for excellence by exploring new frontiers of knowledge, imparting the latest technical knowledge to the students and conducting high quality research.

The department has formulated the curriculum for the B. Tech. program in consultation with various stake holders keeping in mind the current industry practices and future scenarios in civil engineering.

FACULTY OF ENGINEERING & TECHNOLOGY
JAMIA MILLIA ISLAMIA, NEW DELHI

VISION

To become a leading engineering institute through knowledge creation, acquisition and dissemination for the benefit of society and industry.

MISSION

1. To develop a center of excellence by imparting quality education to produce technically sound and research oriented professionals to face the emerging challenges of society and industry.
2. To enhance knowledge by innovative teaching, engaging in cutting edge research and developing linkage with industry.
3. To impart ethical, social and environmental values to produce competent engineers for the service of mankind.
4. To inculcate technological capabilities through continuous interaction with academia and industry in emerging areas for sustainable development.

DEPARTMENT OF CIVIL ENGINEERING

VISION

To emerge as center of excellence for education and research in Civil Engineering and to produce professionally competent and ethically sound engineers of global standards, ready to serve the community and the nation with dedication.

MISSION

1. To provide rigorous hands on civil engineering education through learner centric teaching pedagogy.
2. Establish state-of-the art facilities for teaching and research in civil engineering domain.
3. Motivate students to develop low-cost and sustainable ethical solutions to problems faced by the society.
4. Provide opportunities to students to enable them to develop leadership and interpersonal skills.

Programme Educational Objectives (PEOs)

The department of civil engineering in consultation with stake holders has formulated Programme Educational Objectives (PEOs) that are broad statements describing the career and professional accomplishment that the programme is preparing its graduates to achieve in few years, subsequent upon to receiving the degree. The PEOs of B. Tech. program in civil engineering are as follows:

1. To train and equip graduates in civil engineering with professional skills for successful careers dealing with analysis, design and management of infrastructural projects both in India and abroad
2. To develop core competency in the civil engineering field so as to formulate, analyse and solve civil engineering and allied problems using the principle of mathematics and science.
3. To provide the students with a comprehensive and balanced understanding of the several branches of civil engineering such as structural engineering, geotechnical engineering, transportation engineering, and hydraulic and water resources
4. To inculcate in students high ethical standards, effective oral and written communication skills, to work as part of teams on multidisciplinary projects in diverse professional environments, and to relate engineering issues to the society and nation.
5. To provide student with an academic excellence, leadership, management skills and life-long learning needed for a successful professional career.

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and Write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Upon successful completion of the Bachelor of Technology Program in Civil Engineering, the students should be able to:

PSO1: Analysis and design of foundations and superstructures for residential and commercial buildings using commercial software

PSO2: Design of hydraulic structures, highways, railways, airways, docks and harbors

PSO3: Design, test and evaluate water, sewerage and industrial effluent conveying and treatment systems

PSO4: Survey, map and plan layouts for buildings, roads, and hydraulic structures using modern tools such as the total station

COURSE STRUCTURE 2015

B. Tech. (Civil)

Semester I

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
AS-101	Communication Skills	3	--	--	3	3
AS-151	Language Lab	--	--	2	2	1
AS-102	Engineering Physics - I	2	1	--	3	3
AS-152	Engineering Physics Lab. - I	--	--	2	2	1
AS-103	Engineering Chemistry - I	2	1	--	3	3
AS-153	Engineering Chemistry Lab. - I	--	--	2	2	1
AS-104	Engineering Maths - I	3	1	--	4	4
CE-101	Basics of Civil Engineering	2	1	--	3	3
ME-101	Basics of Mechanical Engineering	2	1	--	3	3
EE-101	Basics of Electrical Engineering	2	1	--	3	3
ME-151	Workshop Practice	--	--	4	4	2
Total		**16**	**6**	**10**	**32**	**27**

Semester II

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
AS-201	Human Resource Management	3	1	-	4	4
AS-202	Engineering Physics - II	2	1	--	3	3
AS-252	Physics Lab. - II	--	--	2	2	1
AS-203	Engineering Chemistry - II	2	1	--	3	3
AS-253	Chemistry Lab. - II	--	--	2	2	1
AS-204	Engineering Maths. - II	3	1	--	4	4
AS-205	Innovative Sciences & Technology	3	1	--	3	4
EC-201	Basics of Electronics and Communication	2	1	--	3	3
CS-201	Fundamentals of Computing	2	1	--	3	3
ME-250	Engineering Graphics	--	--	4	4	2
Total		**17**	**7**	**8**	**32**	**28**

Semester III

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-301	Fluid Mechanics	3	1	-	4	4
CE-351	Fluid Mechanics Lab.	-	-	2	2	2
CE-302	Solid Mechanics	3	1	-	4	4
CE-352	Solid Mechanics Lab.	-	-	2	2	2
CE-303	Engineering Geology	4	-	-	4	4
CE-353	Engineering Geology lab.	-	-	2	2	2
CE-304	Civil Engineering Materials	4	-	-	4	4
CE-354	Civil Engineering Materials Lab.	-	-	2	2	2
CE-305	Numerical Methods	3	1	-	4	4
Total		**17**	**3**	**8**	**28**	**28**

Semester IV

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-401	Structural Analysis - I	3	1	-	4	4
CE-451	Structural Analysis Lab. - I	-	-	2	2	2
CE-402	Hydraulics	3	1	-	4	4
CE-452	Hydraulics lab.	-	-	2	2	2
CE-403	Building Construction	4	-	-	4	4
CE-404	Estimating and Costing	3	1	-	4	4
CE-454	Civil Engineering Drawing	-	-	2	2	2
CE-405	Surveying	3	1	-	4	4
CE-455	Surveying Lab.	-	-	2	2	2
Total		**16**	**4**	**8**	**28**	**28**

Semester V

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-501	Structural Analysis-II	3	1	-	4	4
CE-502	Design of Concrete Structures	3	1	-	4	4
CE-552	Design of Concrete Structure Lab.	-	-	2	2	2
CE-503	Open Channel Flow	3	1	-	4	4
CE-504	Geotechnical Engineering	3	1	-	4	4
CE-554	Geotechnical Engineering Lab	-	-	2	2	2
CE-505	Environmental Engineering - I	3	1	-	4	4
CE-555	Environmental Engineering Lab - I	-	-	2	2	2
CE-556	Surveying Camp	-	-	2	2	2
Total		**15**	**5**	**8**	**28**	**28**

Semester VI

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-601	Advanced Structural Analysis	3	1	-	4	4
CE-602	Transportation Engineering	3	1	-	4	4
CE-652	Transportation Engineering Lab.			2	2	2
CE-603	Design of Steel Structures	3	1	-	4	4
CE-653	Design of Steel Structures Lab			2	2	2
CE-604	Engineering Hydrology	3	1	-	4	4
CE-605	Environmental Engineering - II	3	1	-	4	4
CE-655	Environmental Engineering Lab - II	-	-	2	2	2
Total		**15**	**5**	**6**	**26**	**26**

Semester VII

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-701	Foundation Engineering	3	1	-	4	4
CE-702	Design of Structures	3	1	-	4	4
CE-752	Design of Structures Lab.	-	-	2	2	2
CE-703	Water Resources Engineering	3	1	-	4	4
CE-704	Engineering Economics & Construction Management	4	-	-	4	4
CE-754	Construction Management Lab	-	-	2	2	2
CE-71*	Elective-I	4	-	-	4	4
CE-756	Summer Practical Training	-	-	2	2	2
CE-755	Minor Project	-	-	4	4	4
Total		**17**	**3**	**10**	**30**	**30**

Semester VIII

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-801	Irrigation Engineering	3	1	-	4	4
CE-80*	Elective – II	4	-	-	4	4
CE-80*	Elective – III	4	-	-	4	4
CE-813	Project	-	-	8	8	8
Total		**11**	**1**	**8**	**20**	**20**
Grand Total		**124**	**34**	**66**	**224**	**215**

SEMESTER I

COMMUNICATION SKILLS
AS-101

L: 3 T: 0 P: 0

COURSE OUTCOMES

1. Developing the concepts of communication skills/soft skills
2. Developing the syntactical concepts of grammar
3. Command over professional/technical writing skills
4. Developing a sense interpretation through literature and its social/political and ethical aspect
5. Proficiency in language handling/delivery through English phonetics and accent mechanism

COURSE CONTENTS

Unit-I: THE ART OF COMMUNICATION

English Communication, Technical, Verbal & Non-Verbal Communication, Barriers in Communication, The Art of Communication; Reading, Writing, Listening, Speaking and Strategies to overcome challenges in effective communication.

Unit- II: FUNDAMENTALS OF ENGLISH SYNTAX

Basics of Parts of Speech, Determiners, Use of tenses, Transformation of sentences
Active- Passive; Direct-Indirect; Simple-Compound-Complex sentences, Use of
Prepositions, Discourse Markers, Subject Verb Concord, Use of Conjunctions, Use of Verbs.

Unit-III: WRITING

Formal & informal letters, unmade communication and Demand Communication Note Making, Report writing, Book Reviews, Abstracts and Research Proposals, creative writing, Email correspondences, Résumé writing, Executive summery.

Unit-IV: **WORD VOCABULARY & PHONETICS**

Word formation, foreign roots (Etymology) , Suffix, Prefix, Antonyms, Synonyms, Homonyms, one word substitution, Idioms and Phrases, Acronyms, IPA Symbols, Vowels and Consonants, Place and Manner of Articulations, Phonetic transcription and Accentuation (theoretical insight).

Unit V: Literature

Poetry

Where the Mind is Without Fear- Rabindranath Tagore
The Express- Stephan Spender
Amalkanti-Nirendranath Chkrabarti
Road Not taken- Robert Frost
Soapnut Leaves- Chaaso

Prose

Of Studies- Francis Bacon,
Vanishing Animals- Gerald Durrell
Fitin : Old man and the Sea – E Hemmingnoy
The Child- Munshi Premchand

Prescribed Text Books:

1. *The Joy of Reading*: Orient Blackswan Pvt. Ltd, New Delhi
2. *Fluency in English*: Macmillan Publishers, New Delhi
3. Intermediate Grammar Usage and Composition : M.L.Tikoo and Subramanian , Orient Blackswan Pvt. Ltd, New Delhi
4. A Text Book of English Phonetics for Indian Students: T. Balasubramanian, Macmillan Publishers, New Delhi.
5. Practical English Usage: Michael Swan, Oxford University Press.

Suggested Reading:

1. The Oxford Guide to effective Writing and Speaking Skills: John Seely, Oxford University Press
2. English Pronouncing Dictionary: Daniel Jones, Cambridge University Press.
3. Technical communication Principles and Practice: Meenakshi Raman and Sangeeta Sharma, Oxford.

ENGINEERING PHYSICS – I
AS – 102

L: 2 T: 1 P: 0

COURSE OUTCOMES

1. Enhancing the concepts of conservative and non-conservative forces
2. Understanding the basics of optics and introduction to lasers including their applications in field
3. Expanding the concepts of electromagnetism and its various applications
4. Exploring the basics of quantum ideas: photoelectric effect, Compton effect, Planck's hypothesis etc.
5. Understanding the physics of solids.

COURSE CONTENTS

Unit – I: PHYSICS OF MOTION

Inertial and non-inertial frames, conservation principles of momentum and energy; many particle systems, rocket motion, simple harmonic motion, damped harmonic motion.

Unit – II: OPTICS

Two views about nature of light, concept of coherence, interference of light, single slit and N-slits diffraction, hydrogen atom spectrum, diffraction grating and spectral resolution.

Unit – III: ELECTROMAGNETISM

Cylindrical coordinates, Gradient, divergence and curl, line integral, surface integral and volume integral, Lorentz force, Gauss's law, Ampere's Law, Maxwell's equations, electromagnetic waves and Poynting vector.

Unit – IV: QUANTUM IDEAS

Difficulties of classical Physics, Planck hypothesis, wave particle duality, photoelectric effect, Compton effect, uncertainty principle and its implications, wave packets, group velocity and phase velocity, Davisson Germer experiment.

Unit – V: PHYSICS OF MATERIALS

Classifications of materials, crystal structure, unit cell and lattice parameters, Miller indices, Bragg's law and X-ray diffraction, classical free electron theory, its success and failures, Wiedemann Franz law, Maxwell Boltzmann distribution.

ENGINEERING CHEMISTRY – I
AS – 103

L: 2 T: 1 P: 0

COURSE OUTCOMES

1. Understanding the instrumental methods of analysis
2. Exploring the chemical methods and phase rule
3. Expanding the knowledge of electrochemistry and surfactants
4. Understanding the mechanism, classification, properties and applications of polymers
5. Understanding composites and nanomaterials

COURSE CONTENTS

Unit – I: CHEMICAL AND INSTRUMENTAL METHODS OF ANALYSIS

Gravimetric Analysis; Digestion and its Importance, Favorable Conditions for Precipitation, Volumetric Methods of Analysis; Expression of concentration of solutions Acid-Base (pH metry and conductometry), Redox, Precipitation and Complex metric Titrations. Chromatography; Definition and Different Types of Chromatography, Fundamentals of Spectroscopy; Principles and Applications of UV-Visible, Infra-Red and Atomic Absorption Spectrometry.

Unit – II: ELECTROCHEMISTRY AND SURFACTANTS

Electrolytic and Galvanic cell, Electrode Potential, Standard Electrode Potential, EMF series, Nernst Equation, Cell emf Measurement, Reversible and Irreversible cell, Thermodynamic Overview of Electrochemical Processes, Conductance, Cell Constant and its Determination. Surface Active Agents, Soaps, Types and Advantages of Detergents, Critical Miceller Concentration, Hydrophilic and Hydrophobic Interactions, HLB values, Fricoohesity of Surfactant Solutions.

Unit – III: MOLECULAR STRUCTURE AND PHASE RULE

Valence Bond Theory, Molecular Orbital Theory, Molecular Orbital of Polyatomic Molecules, Molecular orbital Theory of Solids, crystal structure, Semiconductors and Superconductors. Phase Rule; Phase Rule Applications to One and Multiple Component systems, Fe-C Phase Equilibrium Diagram, Types of Alloys, Ferrous and Nonferrous Alloys.

Unit – IV: POLYMERS

Basics of polymer chemistry, Molecular weight, Glass transition temperature and Melting point, Methods of polymerization, Structure property relationship, Thermoplastics and Thermosets, Fabrication of polymers-Compression, Injection, Extrusion and transfer Moulding. Synthesis, Properties and uses of polyethylene, Polyvinyl Chloride, Poly Methyl Methacrylate, Urea formaldehyde resin and Melamine formaldehyde resin, Elastomers and Conducting polymers.

Unit – V: NANOMATERIALS AND COMPOSITES

General Introduction, Fullerenes, Carbon nanotubes, Nanowires, Electronic and Mechanical properties, Synthesis of nanomaterials, Top down and Bottom up approaches, Applications of nanomaterials. Adhesives and their classification, Composites; their Compositions, Characteristics and types.

ENGINEERING MATHEMATICS – I
AS – 104

L: 3 T: 1 P: 0

COURSE OUTCOMES

1. Tracing the curve and understanding its behaviour at the point of infinity (Asymptote).
2. Learning the concepts of successive differentiation and the expansion of functions in form of series.
3. Finding maxima and minima of a function of two and more variables and the concept of Eigen values.
4. A study of ordinary differential equations and its applications.
5. Learning the concepts of partial differential equations with applications.

COURSE CONTENTS

UNIT I: CURVE TRACING & APPLICATIONS OF DEFINITE INTEGRALS

Two Dimensional curve tracing in Cartesian, polar and parametric forms, Double points & points of inflexion, Oblique and parallel asymptotes, Finding length, volume and surface area of the curve in Cartesian, polar and parametric forms.

Unit-II: TECHNIQUES OF ONE VERIABLE CALCULUS & PARTIAL DIFFERENTIATIONS

Leibnitz's theorem; n^{th} derivative of F(x) at x=0, Maclaurin's expansion of F(x), Formation of Intrinsic and pedal equations, Partial derivatives and their geometrical interpretation, Total derivative, Total differential coefficient, change of variables i.e. use of Jacobeans.

Curvature and radius of curvature in Cartesian, polar and parametric and implicit forms, Radius of curvature at the origin, centre and chord of curvature, and evolutes of the curves.

Unit-III: CALCULUS OF SEVERAL VARIABLES & LINEAR ALGEBRA

Taylor's expansion of a function of one & two variables, Leibnitz's rule for differentiation under the sign of integration, Maxima and minima of a function of two and more variables including Lagrange's method.

Consistency of a system of simultaneous linear equations using rank, Eigen values and Eigen vectors of a square matrix, Properties of Eigen values, Applications of Cayley-Hamilton theorem and diagonalization of a matrix, vector space, basis, linear dependence and independence of vectors, Linear transformations and related problems

Unit-IV: ORDINARY DIFFRENTIAL EQUATIONS

Orthogonal and lsogonal trajectories of a family of curves, Complementary function, particular integral and general solution of ordinary linear differential equations of higher order with constant and variable coefficients (Cauchy and Legendre forms).

Method of variation of parameters Method of undetermined coefficients and solutions of simultaneous differential equations with constant coefficients.

Unit-V: PARTIAL DIFFERENTIAL EQUATIONS

Introduction to partial differential equations, Change of independent variables in P.D.E., Complete

solution of homogeneous and non-homogeneous L.P.D.E. of higher order with constant and variable coefficients,
Solutions of one dimensional wave equation, one dimensional heat conduction equations and two dimensional Laplace (Cartesian and polar forms) equation using method of separation of variables.

Text/ Reference Books:

1. A.B. Mathur & V.P. Jaggi : A text book of "Engg. Maths. & Advanced Engg. Mathematics"
2. V.P.Mishra: "Concept of Engineering Mathematics" (Revised Edition)
3. B.S. Grewal: "Engineering Mathematics & Higher Engineering Mathematics"
4. B.V. Ramana: "Higher Engineering Mathematics".
5. R.K. Jain and S.R.K. Iyengar : "Advanced Engineering Mathematics", 4th Edition
6. Dr. J.S.Bindra & K.S. Gill, "Applied Mathematics" S.K. Kataria & Sons, Ansari Road, Darya Ganj, Delhi-110002

BASICS OF CIVIL ENGINEERING
CE-101

L: 2 T: 1 P: 0

COURSE OUTCOMES

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

1. Determine the engineering properties of the materials and solids.
2. Analyze the internal forces for statistically determinate and compound members.
3. Apply the concept of compound stresses for axial, flexure, shear and torsion.
4. Apply the concept of principal strain and strain tensor for the analysis of different structural members.
5. Apply the concepts of shear force, bending moment, axial force for statically determinate beams.

COURSE CONTENTS

Unit-I: Stresses & Strains: Introduction, normal stress & strain, shear stress & strain, relationship between stress and strain, Uniaxial tension test: Stress-Strain diagrams for different materials, Mechanical properties of materials: isotropy, homogeneity, continuity, elasticity, brittleness, yielding, plasticity, work hardening, ductility, hardness, toughness, creep, relaxation, fatigue; Uniaxial deformations: Saint Venant's principle, principle of superposition, free body diagrams, bars of uniform cross sections.

Unit-II: Uniaxial Deformations: Bars of variable cross sections, compound/ composite bars, temperature stresses.

Unit-III: Analysis of Stresses: tensor notations, equilibrium equations, transformation of stresses, invariants of stress tensor, plane stress condition, principal stresses, maximum shear stress and their planes, Mohr's circle.

Unit-IV: Analysis of Strains: transformation of strains, invariants of stain tensor, plane strain condition, principal strains, maximum shear strain and their planes; Strain Rosettes; Stress –Strain relationship, generalized Hooke's law, relation between elastic constants.

Unit-V: Structures and Their Forms: Loads, idealization of structures, supports and connections, elastic and linear behaviour of structures, determinate and indeterminate structures, SF & BM: relation between B.M., S.F. and loads, S.F. & B.M. diagrams in statically determinate simply supported (without overhang) and cantilever beams subjected to concentrated loads and UDL

Text Books

• Engineering Mechanics of Solids By E.P. Popov, Pearson Education.
• Solid Mechanics by S.M.A. Kazimi, Tata McGRAW HILL.
• Mechanic of Materials by R.C. Hibbeler, Pearsons Education

Reference Books

• Mechanics of Materials by Beer & Jonhson, Dewolf, McGRAW HILL.
• Strength of Materials by S. Timoshenko, CBS Publisher
• Strength of Materials by R. K. Rajput, S Chand

BASICS OF MECHANICAL ENGINEERING
ME – 101

L: 2 T: 1 P: 0

COURSE OUTCOMES

1. Understanding various thermodynamic systems, properties and other related concepts
2. Expanding the knowledge of reversible and irreversible cycles
3. Learning the basics of first law and second law equations and related theories with numerical
4. Studying the kinematics of fluid flow
5. Understanding the dynamics of fluid flow

COURSE CONTENTS

Unit-I: Thermodynamics systems, Properties, Thermal equilibrium, Zeroth Law of thermodynamics and concept of temperature. Work, displacement work in various Quasi-state systems, First law of thermodynamics, application to cyclic process, Internal energy, Enthalpy. Pure substance, control volumes, Application of first law to non-cyclic process, Steady Flow energy equation.

Unit-II: Reversible and Irreversible process, Second law of thermodynamics, Kelvin-Planck and Clausius statement and their equality. Entropy generation, Entropy balance equation for closed and open systems.

Unit-III: First law and second laws equations, Maxwell's relation, Carnot cycle. Definition and properties of fluids, Classification of fluids, Normal and shear stresses in fluids.

Unit-IV: Kinematics of fluid flow; Types of flow, flow pattern, Velocity and rotation, acceleration of fluid particle, velocity potential function, Differential equation of conservation of mass.

Unit-V Dynamics of ideal fluids flow; Euler's equation of motion, Bernoulli's equation and its application, Flow measuring device, Venture-meter, orifice-meter and nozzle meter, pilot-static tube, hydraulic co-efficient, Flow through pipes, Major and Minor losses in pipe flow.

Text books:

1. Engineering Thermodynamics by: P. K. Nag, TMH.
2. Fundamental of classical thermodynamics by: Wan- Wylen&sontag, John wiley&sons.
3. Engineering thermodynamics by: Spalding & code.
4. Engineering Mechanics: Statics and Dynamics: by J. L. Meriam and L. G. Kraige, John Wiley & Sons, Inc.

5. Engineering Mechanics: Dynamics: 12th Edition by R. C. Hibbeler, Prentice Hall 6. Engineering Mechanics: by K.L. Kumar, Tata Mc Graw Hill.

BASICS OF ELECTRICAL ENGINEERING
EE-101

L: 2 T: 1 P: 0

COURSE OUTCOMES:

1. To analyse circuit systems using direct application of Kirchoff current and voltage laws along with Ohms law
2. To understand basic concept of "*j*" operator, RLC series circuit, reactive power, true power and apparent power
3. To prepare the students to have basic knowledge of transformers, the equivalent circuit model of single phase transformers, transformer parameters using open circuit and short circuit tests, compute transformer efficiency and voltage regulation
4. Construction and understanding of working principles of DC generators and motors.
5. The ability to select a suitable measuring instrument for a given application like PMMC and MI

COURSE CONTENTS

Unit-I:

Fundamentals of electric circuits, Kirchhoff's laws, mesh analysis, node analysis, delta-star and star-delta conversion, classification of network elements, Thevenin's theorem, Nortan's theorem maximum power transfer theorem, superposition theorem.

Unit-II:

Single phase AC circuits, average and effective values of sinusoids, solution of R,L,C series circuits, the j operator, complex representation of impedances, phasor diagram, concept of power factor, power factor improvement, power in complex notation, solution of parallel and series-parallel circuits, resonance. Introduction to balance three phase AC circuits.

Unit-III:

Ampere's circuital law, B-H curve, solution of magnetic circuits, hysteresis and eddy current losses. Relays as an application of magnetic force. Transformers- construction, e.m.f. equation, ratings, phasor diagram for no load and full load, equivalent circuit, regulation and efficiency calculations, open circuit and short circuit tests, Introduction to Auto-Transformer.

Unit-IV:

Introduction to Electromechanical Energy Conversion, DC motors- construction, e.m.f. and torque equations, characteristics of DC generators and motors, speed control of DC motors. DC motor starter- working principle, ratings. Introduction to three phase induction motor, Introduction to alternator and synchronous motor and their applications.

Unit-V:

PMMC instruments, shunts and multipliers, multi-meters, moving iron ammeters and voltmeters, dynamometer wattmeter, AC watt-hour meters, extension of instrument ranges.

Text Book:

- D.C. Kulshrestha, "Basic Electrical Engineering", Tata McGraw Hill.

- T.K. Nagsarkar&M.S.Sukhija, “Basic Electrical Engineering”, Edition 2008, Oxford University Press.

Reference books:

- V. Del Torro, Electrical Engineering Fundamentals, Second Edition, Prentice Hall of India Pvt. Ltd.
- E. Hughes, Electrical Technology, English Language Book Society Publication with Longman.
- H. Cotton, Advanced Electrical Technology, Issae Pitman, London.
- S.S. Parker, Problems in Electrical Engineering, Asia Publications.
- I. J. Nagarath, “Basic Electrical Engineering”, 2nd Edition, Tata McGraw Hill.

WORKSHOP PRACTICE
ME-151

L: 0 T: 0 P: 4

COURSE CONTENTS

I FOUNDRY: Mould cores, core prints, gates runner, risers, chaplets, common defects in casting, defects due to mould, metal pouring, solidification.

II METAL JOINING: Oxy acetylene gas welding equipment, types of flame, electric arc and contact welding, electrodes and equipments for AC and DC welding, electrode coating functions and constitutes, common welding defects.

III METAL CUTTING OPERATION AND TOOLS: Common metal cutting machine like lathe, milling, shaper, slotter and drill, lathe operations like turning, chamfering, facing, taper turning and knurling, material for lathe tools and other tools, bench grinder and use.

Related Labs:

1. Gas welding: simple joint like joint.
2. Electric Arc Welding: Simple joints like butt joint.
3. Tin Smithy: Mechanical joining, jobs like box, tray, funnel and soldering of joints.
4. Turning: Plane turning, taper turning, threading, knurling, facing and chamfering on the same job.
5. Shaping: Surface finishing at right angles.
6. Milling: Making a slot two or three surface finishing at angles of 1200C.
7. Drilling: Making drilled holes in plates or flats and grinding the corner of a plate to round.

Text books/ Reference books:

1. Elements of Workshop Technology by, Choudhary Vol. 1 & 2. Media promoters and publisher, 1996.
2. Workshop Technology, Vol. 1-3 by W A J Chapman, ELB. S

SEMESTER II

HUMAN RESOURCE MANAGEMENT
AS-201

L: 3 T: 1 P: 0

COURSE OUTCOMES

1. Forming a foundation of human resource management
2. Understanding the procedure of acquisition of human resources
3. Making clear the importance of appraisals and evaluation in human resource
4. Learning importance of training and development of human resource
5. Analysing the management of job stress and employee health and well being

COURSE CONTENTS

Unit-I: Foundation of Human Resource Management (HRM): Meaning, definition, nature and scope, characteristic, objectives, Opportunities and challenges in HRM, HRM functions.

Unit-II :Acquisition of Human Resources –*Human Resource Planning (HRP)*: need, objectives, determinates, HRP models, HRP process, type of HRP, benefits; *Job Analysis (JA)*: sources, methods, process, uses, importance; job description, job specification; *Recruitment and selection:* sources, process, barriers, objectives, objectives of selection, selection tests, interview, induction, placement and employee socialization.

Unit-III: Appraising and evaluating Human Resources –*Performance Appraisal (PA)and feedback:* approaches, methods/techniques of PA, process of PA, interview, elements, designing and conducting PA; *Job Evaluation (JE):* principles, process, methods of JE, importance and limitations.

Unit-IV: Development of Human Resources –*Human Resource Development (HRD):* functions, benefits, importance, barriers to HRD; *Training and Development*: models, methods, training process, training evaluation and barriers.

Unit-V: Employees Health & Well being –Job stress and Job Burnout: Nature, Causes and consequences; *Stress:* Nature, Causes and consequences; *Management of Stress:* Personal and organizational based strategies; *Burnout:* Nature, symptoms, causes, relationship with stress, burnout and job satisfaction management of burnout.

Text Books:

- Gary Dessler (2015), Human Resource Management, Person Prentice Hall of India, New Delhi
- VSP Rao, Human Resource Management, Text & Cases (2nd edition), Excel Books, New Delhi

Reference Books:

- Tapomony Deb, (2009), Managing Human Resource and Industrial Relations (First edition), Excel Books, New Delhi

- John M. Ivancevich (2005), Human Resource Management 93rd edition) Tata McGraw Hill Publishing Co. Ltd., New Delhi

ENGINEERING PHYSICS – II
AS – 202

L: 2 T: 1 P: 0

COURSE OUTCOMES

1. Learn to apply relativity in describing physics of motion
2. Appreciate the importance of lasers and grasp the physical bases
3. Learn the calculation methods of quantum theory
4. Apply quantum ideas to explain behaviour of materials
5. Appreciate physics conservation laws and be acquainted with new areas

COURSE CONTENTS

UNIT- I: RELATIVITY

Difficulties of classical theory, idea of ether, Michelson Morley Experiment, Galilean transformations, postulates of special theory of relativity, Lorentz transformations, Einstein velocity addition theorem, time dilation, length contraction, relativistic mass, momentum and energy, natural units, principle of equivalence.

Unit -II: LASERS

Principle of laser action, Einstein's transition probabilities, lifetime of transitions, rate equation for atomic transition, optical resonators, ruby laser, He-Ne laser, general characteristics of lasers, applications of lasers.

Unit -III: QUANTUM THEORY

Schrodinger equation, time dependent and independent forms, wave function, probabilistic interpretation, one-dimensional problems, particle in a box, elementary treatment of harmonic oscillator, potential barrier and possibility of tunnelling.

Unit -IV: PHYSICS OF MATERIALS

Bose Einstein statistics, Fermi Dirac statistics, semiconductors, intrinsic and extrinsic, carrier concentration, origin of energy gap, Kronig Penney model, Basics of semiconductor devices and applications, Electrical & optical properties.

Unit -V: FRONTIERS OF PHYSICS

Basic interactions, symmetry, invariance and conservation laws, elementary particles and their classification, accelerator physicsand applications, last Nobel prize in Physics, its back ground, significance and possibilities of future developments.

ENGINEERING CHEMISTRY – II
AS – 203

L: 2 T: 1 P: 0

COURSE OUTCOMES

1. Understanding importance of use of water in industries, softening methods and problems on water treatment
2. Understanding basis of fuels analysis and their combustion
3. Exploring the corrosion and protection
4. Understanding environment and pollution
5. Understanding environmental biochemistry

COURSE CONTENTS

Unit -I: WATER TREATMENT:

Water Quality Parameters (BIS & WHO Standards), types of hardness, Units, Determination of hardness by EDTA method, Alkalinity of water & its significance, Numerical problems, Problems with boiler feed water and its treatment; Scale & Sludge formation, Boiler corrosion, Caustic Embrittlement, Priming & foaming, Softening methods; Lime-soda, Zeolite & Ion Exchange processes, Numerical problems, Chlorination of water, Coagulation, Sedimentation and Desalination.

Unit -II: ENERGY RESOURCES:

Types of fuels, Calorific values, (HCV & LCV) and determinations by Bomb and Boys gas calorimeter, Numerical problems, Coal; Types of coal, Analysis of coal, Liquid Fuel; Refining of petroleum, Knocking, Octane and Certance Values, Pollution from fossil fuels, Combustion and Problems. Renewable; (Solar Cells, Rechargeable Batteries, Fuel Cells) and Non-renewable of energy; (Wind Energy, Geothermal Energy, Ocean Energy) resources of Energy.

Unit -III: CORROSION AND ITS PROTECTION:

Corrosion; Definition and its scope, Chemical Corrosion, Electrochemical Corrosion, Mechanism of Chemical and Electrochemical Corrosion, Types of Corrosion; Intergranular Corrosion, Soil Corrosion, Waterline Corrosion, Differential Aeration Corrosion, Galvanic and Concentration Cell Corrosion, Factors affecting corrosion, Protection of corrosion.

Unit-IV: ENVIRONMENTAL CHEMISTRY:

Environment and its Segments, Zones of Atmosphere, Air Pollution: Air pollutants and their resources; Aerosol and its Types, RSPM, SPM, Acid rain, Green House Effect, Global warming, Ozone Layer Depletion, Water Pollution; Sources of water pollution, Sewage Treatment, Determination and Significance of COD, BOD, TOC. Noise Pollution, Soil Pollution, Radioactive Pollution and e-Waste.

Unit-V: ENVIRONMENTAL BIOTECHNOLOGY:

Biotechnology and its applications, fermentation, production of alcohol and vitamins, Biotechnology for environmental Protection, Biological indicators, biosensors, bioremediation, Phytoremediation, bio-pesticides, bio-fertilizers, bioreactors, Social issues, biodiversity and its conservation.

ENGINEERING MATHEMATICS – II
AS – 204

L: 3 T: 1 P: 0

COURSE OUTCOMES

1. Tracing of 3D curves and evaluation of multiple integrals by change of variables/change of order of integration.
2. Learning the concepts of non-linear ordinary and partial differential equations.
3. Study of analytical functions, residues and conformal mapping.
4. Solutions of system of differential equations, integral equation, Integro-differential equations, difference equations using Laplace transformation.
5. Learning of theory of Fuzzy Mathematics with its applications.

COURSE CONTENTS

Unit-I: SOLID GEOMETRY & MULTIPLE INTEGRALS

Formation of equations of cylinder and cone under the given geometrical conditions, Tracing of some quadric (or Conicoids) three dimensional surfaces.

Evaluation of multiple integrals by change of order of integration, Change of variables i.e. Use of Jacobian & Applications of multiple integrals in finding plane area, mass, centre of gravity, centre of pressure, moment of inertia, product of inertia, curved surface area and volume.

Unit-II: ORDINARY & PARTIAL DIFFERENTIAL EQUATIONS

Ordinary point and regular singular point, Series solutions of ordinary differential equations of second order with variable coefficients (polynomials) by the method of Frobenius; Lagrange's method of undetermined multipliers for the solution of linear partial differential equations of first order solution of non-linear partial differential equations of first order by means of transformations and Charpits methods.

Unit-III : COMPLEX ANALYSIS

Analytical function, C-R equations in Cartesian and polar forms, Geometrical representation of $\omega=F(z)$, Determination of conjugate harmonic function, Milne – Thomson meyhod and related problems; Evaluation of complex integrals using Cauchy's integral theorem, Cauchy's integral formula for the n^{th} order derivative of an analytic function.

Taylor series, Maclaurin series and Laurent series expansions of functions, Conformal mapping, sufficient condition for conformality of $W=f(z)$, some standard transformations; zeros, singularities and residues of an analytic function, Application of Cauchy's residue theorem in solving contour integrals and evaluation of real definite integrals using residue method.

Unit-IV: LAPLACE TRANSFORM & ITS APPLICATIONS

Laplace and inverse Laplace transforms of some well-known elementary functions and Special functions, Change of scale property, First and second shifting theorems, Laplace transforms of Derivative, Integral, $t^n f(t)$, $f(t)/t$, Convolution theorem & Periodic function.

Applications of Laplace and inverse Laplace transform in finding the particular solutions of ordinary linear differential equations with constants and variables coefficients, system of differential equations, integral equation, Integro-differential equations, difference equations and, conversion of differential equations into integral equations & vice versa.

Unit-V: FUZZY MATHEMATICS

Fuzzy set, elements of Fuzzy logic, Relations including operations, reflexivity, symmetry and transivity, Pattern classification based on fuzzy relations, fuzzy analysis including metric spaces, distance between fuzzy sets, area perimeter, height, width of fuzzy subsets, continuity & integrals.

Text/ Reference Books

1. A.B. Mathur & V.P. Jaggi: "Engineering. Mathematics & Advanced Engineering Mathematics" (two volume)
2. V.P.Mishra: "Concept of Engineering Mathematics" (Revised Edition)
3. B.S. Grewal: "Engineering Mathematics & Higher Engineering Mathematics",43rd Edition
4. B.V. Ramana: "Higher Engineering Mathematics".
5. R.K. Jain and S.R.K. Iyengar : "Advanced Engineering Mathematics" 4th Edition

INNOVATIVE SCIENCE & TECHNOLOGY
AS-205

L: 3 T: 1 P: 0

COURSE OUTCOMES

1. Understanding the concept of nanotechnology
2. Learning the applications of nanotechnology in multiple disciplines
3. Understanding the concepts of biological sciences, genetics, biological indicators and biosensors
4. Exploring the field of advanced biological sciences and biotechnology
5. Exploring nano-biotechnology and its various applications

COURSE CONTENTS

Unit-I: Introduction to Nanotechnology

Introduction to Nanotechnology, Theoretical Basis of nanotechnology, Quantum confinement and size effect, Classification of Nano materials: Nano wires, Quantum Well and Quantum Dots, Properties of Nano materials, Carbonaceous Nano materials and their examples. Molecular Nanotechnology, Green Nanotechnology.

Unit-II: Applications of Nanotechnology

MicroelectromechanicalSystems(MEMS)&NanoeletromechanicalSystems(NEMS), Nanorobotics,Nanofluidics,Micro-gearsandNano-gears,NanocompositesandtheirapplicationsNanomaterialsforCivilEngineers, Nano-paints, Light and flexible Civil Engg. Structures based on carbon Nano materials, Nano-memories. Nano-sensors. Nano-transistors, Introduction to organic electronics.

Unit-III: Introduction to Biological Sciences

Introduction to the cell as a unit of life, Principles involved in the maintenance of life processes, Ultra-structure and function of cellular components-Prokaryotic and Eukaryotic cells, cell wall, plasma membrane, endoplasmic reticulum, Biomolecules- Carbohydrates. Lipids, Amino Acids, proteins, Nucleic Acids, Tissue Systems. Metabolism, Chromosomes and CellDivision.BasicGenetics-biologicalindicators,bio-sensors,Mutation-causes.typesandeffect.

Unit-IV: Advanced Biological Sciences

Introduction to microbiology, Industrial microbiology, introduction to immunology, Introduction to molecular genetics, Structure of RNA aid DNA, Concept of Gene, Gene regulation, Basic concepts of biotechnology: Tot potency and cell manipulation, Classifications of biotechnologies.

Unit-V: Nanobiotechnology

Introduction to Nano biotechnology, Nano biotechnology in medicine: regenerative medicine, Targeted drug delivery. Nanotechnology in pharmacy, Nano biotechnology in Ayurveda, Alternative medicines. Nan biotechnology in Agricultural, industrial Nan biotechnology, Nan imaging, Cancer treatment using Nanotechnology.

BASICS OF ELECTRONICS & COMMUNICATION
EC– 201

L: 2 T: 1 P: 0

COURSE OUTCOMES

1. Studying semiconductor diodes and their various characteristics
2. Expanding the ideas: construction and working of BJTs and introducing JFET
3. Exploring various types of operational amplifiers
4. Understanding the idea of feedback and thus studying various electronic instruments
5. Learning various parameters of communication systems

COURSE CONTENTS

Unit -I: Semiconductor Diodes:

P-N junction diode, V-I characteristics, static and resistance, linear and non-linear applications of diodes; half wave, full wave and bridge rectifiers, zener diode, characteristics and its use as a voltage regulator, AND, OR, NAND, NOR and Ex-OR gates.

Unit-II: TRANSISTORS (BJT & JFET):

Bipolar junction transistor (BJT) , biasing and amplifier action, load line analysis of transistor amplifier, BJT amplifier configurations and their comparison using small signal h-parameter model, Junction field Effect transistor (FET), biasing and amplifier action.

Unit -III: OPERATIONAL AMPLIFIER:

Op-am- basics, practical op-ampcircuits, inverting and non-inverting amplifier, summing amplifier, integrators and differentiators.

Unit-IV: FEEDBACK AND ELECTRONIC INSTRUMENTS:

Feedback concept, Barkhausen Criteria of oscillation, Wein Bridge and phase shit oscillator, cathode Ray oscilloscope (CRO), electronics multimeters.

Unit -V: COMMUNICATION SYSTEMS:

Introduction to modulation, amplitude modulation generation of AM waves, demodulation of AM wave, introduction to FM.

FUNDAMENTAL OF COMPUTING
CS- 201

L: 2 T: 1 P: 0

COURSE OUTCOMES

1. Students will able to understand the basics of computer, generation & types of computer, its components and number system
2. Students will able to understand the concept of algorithms, flowchart and c programming language
3. Students will able to develop c programs for string manipulation, sorting and searching techniques
4. Students will able to describe the functions, structure and different types of operating systems
5. Students will able to understand basics of networking, internet and database management systems

COURSE CONTENTS

Unit 1: BASICS OF COMPUTERS

Computer fundamentals, Bits and Bytes, CPU, Memory, Types of memory, Input and output devices, I/O devices, Operating system, applications software's, system software. Number system, decimal number system, Binary number system, octal number system, hexadecimal number system. Generation of computer, Classification of computer,

Unit 2: C PROGRAMMING

Algorithms, flow chart, The C character set, constants, variable, keywords, operator and expressions, decision controls, if and else, conditional operator, for loop, while loop and do-while loop,, switch case, user defined functions, call by value and by reference, array, and single dimensional, 2D matrix, multidimensional arrays

Unit 3: SEARCHING AND SORTING

Strings, library string functions, pointers and structures, searching and sorting, linear search, binary search, sorting techniques: bubble sort, selection sort

Unit 4: OPERATING SYSTEM

OS definition, role of OS in computer system, multi programming, time sharing OS, multitasking OS, multiprocessing OS, real time system OS , client server computing, distributed OS, function of OS (user interface, GUI, program execution, I/O management, Resource management,

Unit 5: NETWORKING & DBMS

Network, communication models, transmission media, connection topologies, LAN, WAN, MAN, ISO-OSI model of networking, Internet, ISP, WWW, Email, URL, Web browsers, websites, intranet, DBMS, DBMS applications, Advantage of DBMS, Data abstraction.

Books:

- Reema Thareja, "Computer Fundamentals & Programming in C", Oxford University Press
- Ashok Kamthane, "Programming with C ".
- M N Doja, "Introduction to Computers and Information Technology"
- C Programming by Yaswant Kanetkar

ENGINEERING GRAPHICS
ME-250

L: 0 T: 0 P: 4

COURSE CONTENTS

Unit-I:

ORTHOGRAPHIC PROJECTION: Conversion of pictorial/ isometric views into orthographic views of machine block. Identification of surface in orthographic views. Some practice on auto-Cad package.

Unit-II:

ISOMETRIC PROJECTION: Isometric scale, isometric projection of solids, missing line and missing views. Isometric view of simple objects when their orthographic views are given. Preparation of isometric views using Auto-Cad package.

Unit-III:

SECTIONING: Conventional representation in section of engineering materials. Methods of sectioning, sectional views of machine components, brackets, bushed bearing and foot step bearing. Unit IV FASTENERS: Sketches of different types of threads, permanent fasteners (riveted and welded joints), temporary fasteners (nut and bolt assembly, studs, keys. etc.)

Unit-IV:

BUILDING DRAWINGS: Symbols of electrical and sanitary items. Terminology used in building drawing, plan and elevation of 2/3- rooms building using Auto-CAD package, from corrosion, refractories, their manufacturer and properties: neutral, acid and basic refractors; glass its types and manufacture.

SEMESTER III

FLUID MECHANICS
CE-301

L: 3 T: 1 P: 0

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. develop relationships between different fluid properties and apply them to practical problems
2. analyze the stability of floating and submerged bodies using the principle of floatation.
3. apply the concepts of kinematics to solution of fluid flow problems.
4. apply the concepts of rotational mechanics for the analysis of source, sink, doublet, and flow past stationary and rotating cylinders.
5. apply Bernoulli's energy equation to solve real world problems.

OURSE CONTENTS

Unit-I:

Introduction: Real and ideal fluids, concept of continuum approximation, properties of fluids, equation of state, coefficient of compressibility, bulk modulus of elasticity, Newtonian and non-Newtonian fluid, surface tension, capillarity, concept of viscosity, effect of temperature on viscosity.

Unit-II:

Fluid Static: Pascal's law, devices based on Pascal's law, hydrostatic law, pressure variation in isothermal and adiabatic condition; Manometers: Simple and differential manometers, relative equilibrium; Forces on submerged plane, inclined and curved surfaces; Buoyancy; Stability of floating and submerged bodies, meta center and meta centric height.

Unit-III:

Fluid Kinematics: Kinematics of fluid Motion, Eulerian and Lagrangian description, type of motion, concept of control volume and control surface, streamline, path line, streak line and stream tube, continuity equation in Cartesian coordinate and polar coordinate, one and two dimensional flows, acceleration of fluid element, linear momentum equation and its application- forces on pipe bends.

Unit-IV:

Fluid Rotation: Vorticity and angular velocity in terms of velocity field, irrotational flow, velocity potential and stream function, flow net and its uses, free and forced vortex motion, ideal fluids flow, source and sink, doublet, flow past a stationary and rotating cylinder, Magnus Effects.

Unit-V:

Fluid dynamics: Naivier- Stoke's equation, Euler's equation of motion and integration along streamline; Bernoulli's equation, physical significance of different heads, Bernoulli's equation for isothermal and adiabatic flow; Application of Bernoulli's equation: pitot tube, , venturi meter, orifice meter, mouth pieces; Calibration of flow measuring devices and its applications, Concept of kinetic energy, and momentum correction factors; Flow through an orifice; Flow over a weir and notch; Time required for emptying of tank.

Textbook

1. Frank. M. White, Fluid Mechanics, McGraw-Hill, 7th edition, 2011

References book

1. John F. Doughlas, Janusz M. Gasiorek, John A. Swaffield, and Lynne B. Jack. Fluid Mechanics, Pearson, 2012
2. Bruce R. Munson, Donald F. Young, and Theodore H. Okiishi, Fundamentals of Fluid Mechanics, 5th Edition, John Wiley and Sons, 2006
3. Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, Introduction to Fluid Mechanics, Wiley, 6th ed., 2003
4. A.K .Jain Fluid Mechanics, Standard Publishing House, Delhi,

SOLIDS MECHANICS
CE-302

L: 3 T: 1 P: 0

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. analyse behaviour of structural elements subjected to different types of stresses
2. analyse different types of beams subjected to bending action
3. apply theory of pure bending to determine stresses in different types of structural elements
4. determine slopes and deflection in beams using Macualay's and direct integration methods
5. analyse compression members under axial and flexural loading

COURSE CONTENTS

Unit-I: Thin Cylindrical shells: Longitudinal and hoop stresses, volumetric strains; Thick Cylinders: Lame's equations, stresses due to internal and external pressure; Torsion: Circular and noncircular shafts, power transmitted by shafts; Concept of strain energy and resilience; Theories of failure.

Unit-II: Shear force and Bending moment: SF and BM Diagrams for simply supported over-hanged and cantilever beams subjected to moments and varying loads; SF, BM & Torque Diagrams for inclined beams & brackets subjected to concentrated load, udl, moments and varying loads.

Unit-III Bending in beams: Bending theory, bending equation, bending stresses in rolled steel and built up sections; Shear stresses in beams: shear flow, shear centre, variation of shear stresses in beam cross-section.

Unit-IV: Deflection of beams: Direct integration and Macaulay's methods for simply supported and cantilever beams subjected to concentrated loads, uniformly distributed loads, varying loads and moments.

Unit-V: Columns and struts: Columns and struts subjected to compression and bending, middle third & middle fourth rules, core or kernel of sections, masonry column, dams and retaining walls; Long columns: Euler's, Rankine's and Secant formulae.

Text Books

1. Engineering mechanics of solids, E. P. Popov, Pearson Education.
2. Solids Mechanics, S. M. A. Kazimi, Tata McGRAW HILL.
3. Mechanics of Materials, R. C. Hibbeler, Pearsons.

References:

1. Mechanics of Materials, Beer & Jonhston, Dewolf, McGRAW HILL.
2. Strength of Material, S. Timoshenko.
3. Strength of Materials, R. K. Rajput.

ENGINEERING GEOLOGY
CE-303

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. get the knowledge of earth and its mineral matter
2. get the knowledge of rock and its physical and engineering properties
3. get the knowledge of tectonic activity with details of earthquake
4. get the knowledge of natural land use and soil
5. get the knowledge of site investigation for various types of Civil Engineering projects\

COURSE CONTENTS

Unit-I:

Study of the internal structures such as crust, mantle and core of the earth. Mineral matter and physical properties of the rock forming minerals like metallic and nonmetallic minerals. Significance of minerals in Civil Engineering practices.

Unit-II:

Study of rocks, mode of formation and Classification of Igneous rocks. Physical and Engineering properties of igneous rocks. Relevance of Igneous rocks in civil engineering practices. Mode of formation and classification of Sedimentary Rocks. Physical and Engineering properties of Sedimentary rocks. Relevance of sedimentary rocks in Civil Engineering practices. Mode of formation and classification of metamorphic rocks. Physical and Engineering properties of metamorphic rocks. Relevance of metamorphic rocks in civil engineering practices.

Unit-III:

Study of Tectonic activity of the earth. Explanation of Fold, Fault, Joint and unconformities. Types of Fold, Fault, Joint and unconformities. Relevance of Fold, Fault, Joint and unconformities in Civil Engineering practices.

Unit-IV:

Weathering and erosion. Natural agencies of Weathering and Erosion. Types of Weathering. Formations of various types of landforms. Glacial land forms, wind landforms and fluvial landforms. Significance of various landforms in Civil Engineering practices. Formations of various types of soils.

Unit- V:

Site investigation Techniques. Geological Investigation for Dam site and reservoir, bridges, tunnels and building. Landslide and land subsidence. Study of earthquake, classification of earthquake, earthquake zoning in India. Rocks as engineering material. Hydrologic cycle and study of ground water.

Textbooks

1. A Text Book of Geology by P. K. Mukharji
2. Geology for Engineers By Dr. D.S. Arora
3. Engineering Geology Prabin Singh
4. Geology for Engineers by Krenin & Judd

References

1. Geology and Engineering, by Legeet, McGrawHill Book Company, 1998.
2. Geology for Engineers, by Blyth, ELBS, 1995

CIVIL ENGINEERING MATERIALS
CE-304

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. understand the properties of different types of cement.
2. design concrete mixes and conduct tests on cement and aggregates.
3. use different types of special concretes in construction of structures.
4. understand and use properties of bricks, stones and wood in building construction.
5. understand and use properties of flyash, paints, varnishes, gypsum and water proofing materials in building constructions.

COURSE CONTENTS

Unit-I:

Cement: Compounds and prepositions, types of Portland cement, pozzolanic cement , high alumina cement and other types, hydration mechanism and hydration products, setting and hardening, curing, strength of hardened cement, grade of cement, tests on cements, relevant BIS codes.

Unit-II:

Aggregates: Properties of coarse & fine aggregates, tests on aggregates, relevant BIS codal provisions, concrete: Ingredients of concrete, properties of fresh and hardened concrete, strength of concrete, W/C ratio of porosity, additives and their types, concrete mix design.

Unit-III:

Special Concretes: Reinforced cement concrete, polymer concrete, fibre reinforced concrete, ferrocement, light weight concrete, roller compacted concrete, ready mix concrete, self compacting concrete, high performance concrete, bacterial concrete.

Unit-IV:

Bricks & Stones: Forms of bricks, properties of bricks and stones, tests on bricks and stones, relevant BIS codes, timber: structure of wood, defects in timber, seasoning, preservation, plywood and its manufacturing.

Unit-V:

Other materials: Fly ash paints & varnishes, gypsum, tar, bitumen & asphalt, nano materials, smart materials, composite materials, geosynthetics, heat & sound insulating materials, water proofing materials.

Textbook

1. Building Materials by S.K. Duggal
2. Engineering Materials by S.C. Rangwala
3. Concrete Technology by M L Gambhir
4. Properties of concrete by A M Neville

Reference Books

1. Engineering Materials by R K Rajput
2. Civil Engineering Materials by Neil Jackson
3. Design of concrete mixes by Krishna Raju N, CBS publishers
4. Concrete Technology by Neville A.M and Brooks. J.J. PEARSON education.
5. Concrete properties and manufacturing by Akroyd T.N.W, Pergamon press

NUMERICAL METHODS
CE-305

L:3 T:1 P:0

COURSE OUTCOMES

1. Students will be able to interpolate values of a function at a given intermediate value to formulate most of the application problems in science and engineering.
2. Student will be able to interpolate values of successive derivations of a tabulated function and single integral as well as multiple integral provides.
3. The students will be able to find roots of algebraic and transcendental non-linear equations involving one and more variables.
4. The students will be able to solve complex system of simultaneous linear equations and to fit variety of curves.
5. The students will be able to solve higher order differential equation numerically and boundary value problems.

COURSE CONTENTS

Unit-I: INTERPOLATION WITH EQUAL & UNEQUAL INTERVALS OF THE ARGUMENT

Newton-Gregory, Gauss, Stirling and Bessel Formulae, Aitken & cubic spline interpolation methods for equal intervals; Newton's divided difference and Lagrange's formulae for unequal intervals; Inverse interpolation using. Lagrange's formula, method of successive approximation and double interpolation.

Unit-II: NUMERICAL DIFFERENTIATION & NUMERICAL INTEGRATION

Numerical successive differentiation using Forward, Backward, Central difference interpolation formulae. Newton's divided difference formula. Review of Trapezoidal, Simpson's 1/3 and 3/8 rules, Numerical integration using Boole's rule, Weddle's rule, Gauss-Legendre, Lobatto, Radau and

Gauss-Chebyshev rules. Errors in Quadrature formulae, Romberg integration and Numerical double integration.

Unit-III: NUMERICAL SOLUTIONS OF ALGEBRAIC & TRANSCENDENTAL EQUATIONS

Bisection, Regula-False position, Newton-Raphson & Graeffe's Root-Squaring method for the solution of non-linear algebraic & transcendental equations involving one variable, rate of Convergence and error analysis of the methods, Newton-Raphson method for the solution of a system of non-linear equations of two variables.

Unit-IV: NUMERICAL SOLUTION OF A SYSTEM OF SIMULTANEOUS LINEAR EQUATIONS & CURVE FITTING

Gauss Elimination & Gauss-Jordan methods, III conditioned linear system, Gauss-Seidal and Crout methods for the solution of a system of linear equations in four unknowns; General curves (linear, quadratic, exponential and other non-linear functions) fitting using methods of least squares.

Unit-V: NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS & BOUNDARY VALUE PROBLEMS

Numerical approximate solutions of a system of simultaneous and higher order differential equation using Taylor's series method, Picard's method and Runge-Kutta fourth order method; Runge-Kutta, Fehlberg method, Modified Euler and Milne methods; Solution of boundary value problems using finite differences method and cubic spline method.

Books:

1. M.K. Jain, S.R.K. Iyengar & R.K. Jain: "Numerical Methods for Scientific and Engineering Computation", 4th Edition, New
2. Age International Publisher, Daryaganj, New Delhi-01
3. S.S.Sastry: "Introductory Methods of Numerical Analysis", 4th edition, Prentice Hall of India, Jhilmil House, Patparganj, New
4. Delhi.
5. Steven C. Chapra & Raymond P. Canal, "Numerical Methods for Engineers", Tata McGraw Hill Book Co.
6. V. Rajaraman, "Computer Oriented Numerical Methods", Prentice Hall of India Pvt. Ltd.
7. Madhumangal Pal, "Numerical Analysis for Scientists & Engineers, Theory & C Programs", Narosa Publishing House, Daryaganj, New Delhi – 110002.
8. Shanta Kumar M, "Computer Based Numerical Analysis", Khanna Publishers, Delhi – 110002.
9. B.S. Grewal, "Numerical Methods in Engineering & Science with Programming in C/C++", Khanna Publishers.
10. Radhey S. Gupta; "Elements of Numerical Analysis", Macmillan India Ltd.

SEMESTER IV

STRUCTURAL ANALYSIS-I
CE-401

L: 3 T: 1 P: 0

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand the concept of load calculations for structural analysis
2. identify determinate, indeterminate, stable and unstable structures
3. apply different methods for the determination of slope and deflection in determinate structures
4. determine forces in determinate trusses, beams and frames
5. plot influence lines for beams trusses and three-hinged arches.

COURSE CONTENTS

Unit-I:
Forms of Structures: beams, trusses, arches, cables, industrial frames, multistory building frames, shell structure etc.; Loads: DL, imposed loads (LL, WL, seismic load, snow load, erection load etc.); Idealization of structures; types of supports; stability and static determinacy & indeterminacy to beams & frames; free body diagram; Arch structures: 3-hinged parabolic & circular arches, thrust, radial shear and bending moment diagram, spandrel braced arches.

Unit-II:
Deflection of beams: Moment area method, conjugate beam method, application of these methods to statically determinate beams & frames; Flexural stiffness of beam with far end pinned & fixed, carry over factor, fixed beams, propped cantilever beam.

Unit-III:
Energy methods: Forms of elastic strain energy, axial stress, shearing stress, multi-axial state of stress; Impact load, suddenly applied load, gradually applied load, static load, quasi-static load; Strain energy in members: axial loaded members, under bending, under shearing, circular members under torsion; Law of conservation of energy: virtual work, virtual work on rigid body, virtual work on elastic body; Betti's law and Maxwell's law of reciprocal deflection, application of virtual work on beams (application of product integral table); flexural stiffness of beam with far end pinned; Deflection of statically determinate rigid frames.

Unit-IV:
Deflection of pin jointed plane trusses: Method of virtual work; Unit load method; Castigliano's theorems, application of Castigliano's theorems to brackets, lamp posts & curved members; Deflection of truss due to temperature variation; fabrication error and camber.

Unit-V:
Influence Line for Statically determinate structures: Influence Lines, Influence Lines for Beams, Qualitative Influence Lines, and Influence Lines for trusses and three-hinged arches.

Textbook

1. Structural Analysis, by R. C. Hibbeler, Pearsons
2. Structural Analysis by C. S. Reddy, Tata McGrawHill

References

1. Intermediate Structural Analysis by C. K. Wang, Tata McGrawHill
2. Structural Analysis by Pandit & Gupta, Tata McGrawHill
3. Structural Analysis, by T.S., Thandavamoorthy, Oxford Higher Education

HYDRAULICS
CE-402

L: 4 T: 0 P: 0

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. apply concepts of similitude to model investigation
2. analyse laminar and turbulent flow through circular pipes
3. apply momentum equation for the solution of practical problem
4. analyse pipe flow problems through network of pipes
5. design and conduct experiments on pumps and turbine.

COURSE CONTENTS

Unit-I:

Dimensional and Model Analysis: Dimensional analysis and its utility; Buckingham's pi-theorem and Raleigh's method and their application to fluid flow problems; Dimensionless parameter in fluid flow and their relevance; Similarities: Application of dynamic similarity to model investigations, scale ratio for distorted model.

Unit-II:

Laminar flow: Flow through circular pipes, flow through parallel plates and coaxial cylinders, power absorbed in viscous flow, concept of friction factor, measurement of viscosity, Reynolds's number and its significance; Boundary Layer: Boundary layer along a thin plate and its characteristics, laminar and turbulent boundary layer, laminar sub- layer; Displacement, energy and momentum thickness, separation of boundary layer and its control, drag and lift.

Unit-III:

Turbulent Flow: Nature of turbulent flow and its origin, Reynolds's stress, Prandtl's mixing length hypothesis; Momentum integral equation; Hydro dynamically smooth and rough boundaries, Velocity distribution for turbulent flow in smooth and rough pipes; Friction factor in smooth and rough pipes, Moody's diagram, and Colebrook's equation.

Unit-IV:

Pipe flow: Hazen William & Darcy Weisbasch equation, minor and major losses, hydraulic gradient and total energy line; Pipes in series and parallel; Concept of equivalent length, Dupuits equation; Siphon, water hammer, two reservoir problem, pipe network, Hardy cross method, Time of emptying a reservoir through a pipe, power transmission through pipes.

Unit-V:

Pumps: Reciprocating Pumps, working principal of both double and single reciprocating pump, indicator diagram frictional loss, centrifugal pump, their advantages over reciprocating pump, classification of centrifugal pump, operation of centrifugal pump in series and parallel. Turbine: General layout of hydroelectric power plant, impulse and reaction turbines, efficiency of turbines, classification based on discharge, head and specific speed, unit power and unit discharge.

Textbook

1. Robert L Daugherty, Fluid Mechanics with Engineering Applications, McGraw-Hill

References book

1. John F. Doughlas, Janusz M. Gasiorek, John A. Swaffield, and Lynne B. Jack. Fluid Mechanics, Pearson, 2012
2. Bruce R. Munson, Donald F. Young, and Theodore H. Okiishi, Fundamentals of Fluid Mechanics, 5th Edition, John Wiley and Sons, 2006
3. Modi, P. N. and Seth, S. M. Hydraulics and Fluid Mechanics, Standard Publishing House, Delhi, 2009
4. A.k. Jain Fluid Mechanics, Standard Publishing House, Delhi,

BUILDING CONSTRUCTION
CE-403

L: 4 T: 0 P: 0

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. understand various types of foundation, their functions and essential requirements
2. understand different types of masonry structure and their construction methods
3. apply the knowledge of different types of floors, roofs, stairs and escalators in civil engineering
4. understand various types of doors, windows, lintels, arches, building finishes and formworks with their applications
5. apply the knowledge of damp proofing treatment and sound insulation techniques in buildings

COURSE CONTENTS

Unit-I:

Foundation: Functions of Foundations, Essential requirements of a good Foundation, Types of Foundations; Shallow Foundations, Deep Foundations.

Unit-II:

Masonry: Stone Masonry and Brick Masonry, Different terms used in Masonry, Bond and its types, Composite Masonry, Panel Walls, Load Bearing Walls, Compound Walls, Cavity Walls, Partition Walls.

Unit-III:

Floors and Roofs: Flooring: General Considerations, Different types of Floorings, Flat-Floor and Flat-Roof Construction, Different types of Upper Floors.
Sloped Roofs: Types of Sloped Roofs.
Stairs and Escalators: Requirements of a good stair, Location and Types.

Unit-IV:

Doors and Windows: Doors, Windows and Ventilators; Location, Size, Classification and details.
Lintels and Arches: Different types.

Building Finishes: Plastering, Pointing, Painting and Polishing, White/Color washing, Plastic Paints. Formwork: Shuttering and Scaffolding.

Unit-V:
Damp Proofing and Water Proofing: Treatment of Floors, Walls and Basement, Miscellaneous Topics- Fire Protection, Thermal and sound Insulation of Buildings.

Textbook

1. Building Construction by BC Punmia & AK Jain
2. Building Construction by PC Varghese
3. Building Construction & Material by Gurcharan Singh
4. Building Construction by Sushil Kumar

ESTIMATING AND COSTING
CE-404

L: 3T: 1 P: 0

COURSE OUTCOMES

1. Students will be familiar with planning of residential buildings.
2. Students will be able to understand the various methods for estimation of buildings.
3. Students will be familiar with the contract system in the civil engineering.
4. Students will be able to understand the computation of earth work and different types of earth works
5. Students will be able to understand the importance of valuation in construction, rent fixation and tenders.

COURSE CONTENTS

Unit-I:
Introduction: Definition of estimate, Quantity Survey, plinth area, covered area and floor area estimates, data required for the preparation of estimate, types of estimate, methods of estimating, long wall short wall method and center line method, units of measurements and degree of accuracy in estimating (as per 27- 1984)

Unit-II:
Building Estimates: Preliminary estimates of building by given plinth area, floor area and covered area, various forms used in estimating, estimation of two room building by long wall short wall method and center line method.

Unit-III:
Analysis of rates, purpose of analysis rate, to fix up rate per unit of an items, requirement of rate of analysis for materials and labor (skilled & unskilled), factors affecting rate of analysis of rate for concrete work, brick work and plastering.

Unit-IV:
Estimate of multistory building, tender, tender notice, tender form, tender documents, notice inviting tender (NIT), global tender, informal tender, unbalanced tender, abstracting, methods of taking out quantities, computation of earth work.

Unit-V:

Importance of valuation in construction, credential of valuer, classification of value- definition, assessed value, book value, market value, salvage value, scrape value and capitalized value, valuation & purpose of valuation, terms used in valuation.

Textbook

1. Estimating and costing by B N Datta, S S Dutta and Co.
2. Estimating and costing for civil Engineering by G S Birdie
3. Building Drawing by Shah, Kale and Patki
4. Estimating and Costing in Civil Engineering Theory and Practice, by Dutta B.N

SURVEYING
CE-405

L: 3 T: 1 P: 0

COURSE OUTCOMES

Upon successful completion of the course, a student should be able to:

1. apply the fundamental of surveying and measurement of distances to real world problem.
2. apply different techniques of measurement of elevations to real world problem.
3. establish control points and plot topographical maps.
4. compute area and volume from ground data and maps.
5. set out horizontal and vertical curves on the ground.

COURSE CONTENTS

Unit-I:

Classification of surveying, basic principles, measurement of horizontal distance by conventional methods, sources of errors; Measurement of angles and bearings, traversing and triangulation survey Use of theodolite, computation of coordinates

Unit-II:

Leveling: definition of terms, leveling principle, methods of booking and reduction of levels, errors in leveling, curvature and refraction correction, Trigonometrical levelling

Unit-III:

Topographical survey: characteristics, plotting and uses of contours; Tacheometric survey-stadia tacheometry and tangential tacheometry ; Total station: basic components, fundamental and advance measurement functions

Unit-IV:

Computation of area by different methods, estimation of volume of earthwork; Setting out of building and tunnel; Reconnaissance, preliminary and detailed survey for canals, highways, railways, sewer lines

Unit-V:

Elements and geometry of horizontal curve, setting out of simple curve by linear and angular methods, compound, reverse and transition curves, Basics of vertical curves, setting out of vertical curve

Textbook

1. Elementary Surveying, Charles D. Ghilani, Paul R. Wolf. 14th Edition, Prentice Hall, 2014.
2. Surveying-Bannister, Raymond and Baker, Pearson Education

References

1. Surveying and Leveling, T. P. Kanetkar and S.V.Kulkarni Vol.1 & 2, Vidhyarthi Griha, Prakashan, Pune
2. Plane and Geodetic Surveying for Engineers, David Clark and Jackson J. E., CBS Publications and distributors, New Delhi.
3. Advanced Surveying, Agor, Khanna Publications, Delhi.

SEMESTER V

STRUCTURAL ANALYSIS-II
CE-501

L: 3 T: 1 P: 0

COURSE OUTCOMES

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

1. analyse indeterminate beams, frames and trusses (degree one & two) by using Force/ Flexibility/ Compatibility/ Consistent Deformation Methods.
2. analyse the beams for symmetrical/ unsymmetrical bending; and analyse cables; suspension bridges with three & two hinged stiffeneing girders.
3. analyse continuous beams/ intermediate beams and frames (sway problems) by using Three Moment Theorem and Slope Deflection Methods.
4. analyse fixed beams/ portal frames by Column Analogy method and analyse Indeterminate Trusses, Mill Bents, portal frames, continuous beams and building frames by Cantilever and Portal methods.
5. analyse different structures by developing Stiffness/ Displacement matrices.

COURSE CONTENTS

Unit-I:
Introduction: Force/flexibility/ compatibility/ consistent deformation method of analysis; Superposition, compatibility & equilibrium, flexibility coefficients, flexibility matrices, application of the method to indeterminate beams, frames and trusses to degree one & two.

Unit-II:
Unsymmetrical bending : Introduction, double symmetric beams with skew loads, pure bending, shear flow and shear center; Analysis of cables; Analysis of suspension bridges with three & two hinged stiffening girders.

Unit-III:

Indeterminate Structures : Continuous beam- Three Moment Theorem; Slope deflection method and its application to analysis of indeterminate beams & frames, yielding of supports, sway problems.

Unit-IV:
Column analogy method: Application to fixed beams, properties of symmetrical analogous column, analysis of portal frames.
Approximate analysis of statically indeterminate structures: Indeterminate Trusses, Mill Bents, portal frames, continuous beams and building frames, cantilever method and portal method.

Unit-V:
Stiffness/ Displacement method, Development of stiffness matrix for pin jointed structure and frames, development of method for a structure having forces at all degrees of freedom, development of method for a general case, direct stiffness method.

Textbook

1. Intermediat Structure Analysis By C.K. Wang, Tata McGraw-Hill.
2. Structure Analysis By Pandit & Gupta, Tata McGraw-Hill.
3. Basic Structural Analysis By C.S. Reddy, Tata McGraw-Hill.
4. Structure Analysis By Thandavamoorthy, Oxford

References

1. Structure Analysis By Norris & Wilbur.
2. Basic Concepts of Structure Analysis By Beaufait, F.W.
3. Examples in Structural Analys By William M. C. McKenzi.

DESIGN OF CONCRETE STRUCTURE
CE-502

L: 3 T: 1 P: 0

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. understand the importance of RC structural design basic concept, working stress method.
2. apply the theory of limit state design of RCC structural members using first principles.
3. have adequate understandings of relevant Shear.
4. gain knowledge about Indian standards, use of design charts & table for design of beams and slabs.

COURSE CONTENTS

Unit-I:
Characteristic strength, stress-strain relationship for concrete and steel, IS specifications (IS 456, 875 & 1893), characteristic imposed loads, DL, EL & WL. Design philosophies – Working stress method and limit state method. Strength and serviceability requirements, Analysis and design for flexure of singly / doubly rectangular and flanged beam sections – by working stress method.

Unit-II:
Analysis and design for flexure of singly / doubly rectangular and flanged beam sections – by limit state method. Serviceability limit states for deflection and cracking, requirements for curtailments and detailing of reinforcement, minimum / maximum tension and compression reinforcement, minimum & maximum spacing of bars; Introduction and use of design aid (SP-16), calculation of deflection.

Unit-III:
Bond stress: flexural & anchorage bond stress, design bond stress, development length, anchorage length; Behaviour of beams in shear, design for shear & torsion as per limit state method; Reinforcement detailing.

Unit-IV:
Complete design of a cantilever and simply supported beam with and without overhang; Design of continuous beams with Rectangular, T & L sections; Introduction to slabs: rectangular slab, one way simply supported & continuous slab and their design; Comparison of manual design with the software available.

Textbook

1. R. C. C. Design by Pillai and Menon, Tata McGraw Hill
2. Reinforced Concrete Design by S. N. Sinha, Tata McGraw Hill
3. Limit State Design by P. C. Verghese, Prentice Hall
4. Reinforced Concrete Limit State Design , Ashok K Jain Namechand & Bros Rorkee

References

1. Structural Analysis by Norris, Wilbur
2. "Code of Practice for Plain and Reinforced Concrete", BIS, New Delhi, IS456-2000.
3. "Design Aids for Reinforced Concrete to IS 456", Special Publication (SP16), BIS New Delhi,1980.
4. "IS: 1343- 1980, IS Code Of Practice For Prestressed Concrete", BIS, New Delhi, 1980

OPEN CHANNEL FLOW
CE-503

L: 3 T: 1 P: 0

COURSE OUTCOMES
Upon successful completion of the course a student should be able to:
1. understand geometrical properties of channel sections of different shape.
2. apply the concept of specific energy in the analysis of channel transitions.
3. understand and analyze flow profiles on different sloped channels.
4. analyze rapidly flow problems with focus on practical applications to real-world problems.
5. understand the importance of devices used in the measurement of flow through channels.

COURSE CONTENTS
Unit-I:

Introduction: classification of open channel flow. Geometric properties of channel section, Velocity and Pressure distribution in Channel Flow, Kinetic energy and momentum correction factors. Uniform flow, Application of Manning's and Chezy's formulae.

Unit-II:
Specific Energy: Critical Flow, Specific Energy and Force. Transitions in channels, channel with a hump, transition with change in width, choking flow. Channel conveyance, section factor for critical flow and uniform flow computations. Most economical section of a channel.

Unit-III:
Gradually varied flow: Gradually varied flow equation, assumptions and different forms of the equation, characteristics and classification of flow profiles. Analysis of flow profiles on mild, steep, horizontal and adverse slopes. Solution of the gradually varied flow equation, Graphical integration method, Direct step method and standard step method.

Unit-IV:
Rapidly varied Flow: Hydraulic Jump, its definition and types. Momentum equation for the jump, Characteristics of jump in horizontal rectangular channel, Computation of energy loss and length, location of jump, and pressure distribution. Energy dissipaters

Unit-V:
Measuring Devices in Open Channel: Flow in channels with sharp & broad crested weir. Flow measurement with non rectangular weirs; Triangular, circular and parabolic weir. Discharge using linear proportional weir, Sutro weirs, Quadratic weir, Ogee spillway and sluice gate.

Textbook

1. Open channel flow by V.T Chow. McGraw Hill.

References

1 Flow in Open channels by K Subramanya.Tata McGraw- Hill.
2 Flow in Open channels by RangaRaju.Tata McGraw- Hill.

GEOTECHNICAL ENGINEERING
CE 504

L: 3 T: 1 P:0

COURSE OUTCOMES
The students will be able to

1. understand soil identification, index properties and their determination, and phase diagram of the soil.
2. solve 1-D, and 2-D problems of flow through soils.
3. calculate vertical stresses in the soils due to overburden and applied loads
4. interpret compaction and consolidation characteristics of different soils.
5. evaluate shear strength parameters of the soils and their application in geotechnical problems.

COURSE CONTENTS
Unit-I: Classification and Properties

Origin and formation of soils, Soil Structure and Fabric, Three Phase System and Phase Relationships, Classification: Unified and IS Classification System, Index Properties

Unit-II: Flow Through Soils
Permeability, one dimensional flow, Darcy's Law, Two dimensional flow, Flow nets, uplift pressure, piping

Unit-III: Stresses in Soil
Total, Neutral and Effective Stresses, Seepage Force, Quicksand condition, Stress Distribution under applied loads: Boussinesq's and Westergaard's Equations, Newmark's Chart

Unit-IV: Compaction and Consolidation
Compaction: Lab and Field Compaction, Proctor Compaction Tests; Compressibility, One dimensional consolidation and its time rate.

Unit-V: Shear Strength and Lateral Earth Pressure
Shear Strength: Mohr-Coulomb strength criteria, Direct and Triaxial shear tests, Vane Shear Test, Unconfined Compression Test, Drainage Conditions, Stress Paths, Shear Strength Parameters; Lateral Earth Pressures: Active, Passive and Pressure at rest, Rankine's and Coloumb's Theories.

Books:

1. Soil Mechanics and Foundation Engineering by K R Arora, Standard Publishers Distributor
2. Soil Mechanics and Foundation by Punmia, Jain and Jain; Laxmi Publications (P) Ltd.
3. Engineering Properties of Soils by S K Gulati, Tata McGrawhill

ENVIRONMENTAL ENGINEERING – I
CE-505

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand various important parameters required for design of water supply systems
2. understand design of various components of water supply systems
3. understand important water quality parameters
4. understand basic principles and design philosophies of various treatment operations and process
5. understand advanced methods of water treatment

COURSE CONTENTS

Unit-I:
Water demand: Types of demands, factors affecting per capita demand, variations in demand; Population forecasting; Sources of water supply: estimation of water quantity, factors governing the selection of source; Water conservation measures.

Unit-II:
Intakes: Types of intakes, factors governing the location of intake; Reservoirs: types of reservoirs, capacity of reservoir; Water distribution system: requirements of a good distribution system,

methods of distribution, layout and design of water supply systems; Pipes: types of pipes for transporting water, pipe appurtenances, testing of pipelines.

Unit-III:
Water Quality: Physical chemical and microbiological water quality parameters and their significance; Water borne diseases and their control; drinking water quality criteria and standards; Natural processes occurring for self-cleansing of water bodies; Engineered systems of water treatment

Unit-IV:
Aeration: Mechanics of gas transfer, types of aerators, applications of aeration; Sedimentation: theory of sedimentation, design of sedimentation tank, types of sedimentation tanks; Coagulation: theory of coagulation, types of coagulants and coagulant aids, and flocculation, design of flocculation tank.

Unit-V:
Water softening: Chemical precipitation, ion exchange; reverse osmosis; Filtration: theory of filtration, types of filters and their classification, filter operations; disinfectioning: types of disinfectants, chlorination; Site selection for treatment plant; layout considerations for treatment plant; Operation and maintenance of treatment plants.

Textbooks

1. Modi PN, Water Supply Engineering (Environmental Engieering – I), Standard Book House, 2010
2. Garg Santosh Kumar, Water Supply Engieering

References

1. Qasim Syed R, Motely Edward M, Zhu Guang, Water Supply Engineering, PrenticHall of India 2006
2. Peavy Howard S, Rowe Donald R, Tchobanglous Geroge, Environmental Engineering, McGraw Hill Education (India) Pvt Ltd 2013
3. Sincero Arcadio P, Sincero Gregoria A, Environmental Engineering – A Design Approach, Prentice Hall of India 2010
4. Gray NF, Water Technology – An Introduction for Environmental Scientists and Engineers, Elsvier, 2nd Ed.
5. Davis Machenzie L, Water and Wastewater Engineering – Design Principles and Practice, McGraw Hill Education (India) Pvt Ltd 2014
6. CPHEEO, Manual on Water Supply and Treatment, Central Public Health and Environmental Engineering Organization, Ministry of Urban Development, Government of India.
7. Walter J, Weber Jr, Physicochemical Processes for Water Quality Control, John Wiley & Sons, 1972

SEMESTER VI

ADVANCE STRUCTURAL ANALYSIS
CE-601

L: 3 T: 1 P: 0

COURSE OUTCOMES

1. To analyze structures subjected to rolling loads.
2. To analyze beams, portal frames and gable frames using moment distribution method
3. To analyze beams using plastic theory
4. To apply basic concepts of structural dynamics for the analysis of structures
5. To analyze the behavior of two-hinged and fixed arches

COURSE CONTENTS

Unit-I:

ILD and its application: Single concentrated load, UDL (shorter and longer than span), two concentrated loads, series of concentrated loads for maximum shear force at a section, BM under a given load, maximum BM at a given section, absolute maximum shear & moment in beams; Muller Breslau principle and its application

Unit-II:

Moment distribution method: Member stiffness factor, joint stiffness factor, carry over factor, distribution factor, procedure for analysis, application to continuous beams and frames with and without sway, symmetrical and unsymmetrical frames

Unit-III:

Plastic Analysis: Basis of plastic theory, bending of beams symmetrical about both axes, fundamental conditions for plastic analysis, rigid plastic analysis, analysis of beams and frames

Unit-IV:

Structural Dynamics: Introduction, various terms used in the vibration analysis: Simple harmonic motion, free or natural vibrations, damping, damping coefficient, mass and stiffness.

Unit-V:

Two-hinged and hingeless arch: analysis of symmetrical arch, temperature effect, elastic centre method

Text Books

1. Intermediate Structural Analysis by C. K. Wang, Tata McGrawHill
2. Structural Analysis by Pandit & Gupta, Tata McGrawHill
3. Strength of Materials by B C Punmia
4. Structural Analysis by B C Punmia

Reference Books

1. Structural Analysis by Norris, Wilbur
2. Structural Dynamics by M Mukhopadhyaya
3. Dynamics of Structures by Chopra
4. Earthquake Resistant Design of Structures By Pankaj Agarwal and Manish Shrikhande, Publication, Prentice Hall of India Pvt. Ltd.
5. Seismic Analysis of Structures by T K Datta, Wiley

Software or other Requirement

- STAAD Pro

TRANSPORTATION ENGINEERING
CE-602

L: 3T: 1 P: 0

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. gain knowledge on highway planning, alignment surveys and project preparation.
2. learn basic concepts of highway geometrics and geometric design of roads and intersections.
3. understand basic concepts, analysis and design of traffic flow and traffic facilities.
4. gain knowledge of different highway materials and their characteristics. Design of mix and flexible pavements using IRC Codes.
5. Design the rigid pavements using IRC Codes. Gain knowledge of construction, maintenance and drainage of highways.

COURSE CONTENTS

Unit-I:

Introduction: Importance of Transportation, Different modes of transportation, Brief history of road development around the world. Twenty year road development plans, Necessity of highway planning, Road patterns, Preparation of Master Plan and its phasing, Highway alignment, Engineering and other surveys for highway location, Highway projects evaluation.

Unit-II:

Highway Geometric Design: Introduction Design speed, Highway cross – section elements, Analysis of sight distances, Design of horizontal and vertical alignments – all pertinent elements, Types of intersection, Principles of intersection design.

Unit-III:

Traffic Engineering: Traffic characteristics, traffic studies – volume, speed, origin and destination, parking and accident studies, Traffic controls- traffic signs, marking and traffic signals, Highway capacity, Signal design.

Unit-IV:

Highway Materials: Subgrade soil, aggregates and bituminous material; different tests on these materials. Bituminous mix design, pavement types, Soil stabilized roads. Pavement design: Introduction, Design parameters, Design of flexible pavement (IRC method).

Unit-V:

Design of rigid pavement (IRC method), construction of WBM road, bituminous pavements and cement concrete pavement, Highway maintenance and drainage.

Textbooks

- Highway Engineering by Khanna, Justo and Veeraragavan, Nem Chand and Bros, Roorkee.
- Transportation Engineering by Chakroborty and Das, PHI.
- Relevant IRC codes.

References

- Transportation Engineering and Planning by Papacostas and Prevedouros, PHI.
- Pavement analysis and design by Y H Huang, Pearson Prentice Hall.
- Specifications for roads and bridges by MoRTH (Ministry of Road Transport and Highways, Govt of India, V Revision)

DESIGN OF STEEL STRUCTURES
CE-603

L: 3 T: 1 P: 0

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. learn the concept of analysis and design of steel structures.
2. analyze and design of bolted and welded connections.
3. analyze and design of tension members with different failure criteria.
4. analyze and design of columns/buit up columns with various configurations and end conditions.
5. analyze and design of laterally supported and unsupported beams.

COURSE CONTENTS

Unit-I:

Design of Connections: Common steel structure, advantages and disadvantages of steel structures, type of steel, rolled steel sections, special considerations in steel design, design philosophy, limit state design, design strength, deflection and serviceability limits, stability checks; Riveted, bolted and welded connections, classification of bolts and types of bolted connections, **IS 800-2007** specifications for design of bolted connections, worked examples on design of bolted joint, shear capacity and tension resistance of bolts **(IS-1364)**, design examples of fillet and butt weld connections, design of eccentric bolted and welded connections.

Unit-II:

Design of Tension members: Design strength of tension member due to yielding of gross section, rupture strength of critical section and block shear, tension splices and lug angles; design of bolted and welded connections for ties subjected to both bending and axial tension.

Unit-III:

Design of Compression members: Shape of compression members, buckling class of cross–section, slenderness ratio, design compressive stresses and strengths, use of IS800-2007 tables for design stresses, design of compression members, design of laced and battened columns, design of column splices; Column bases: design of slab base and gusseted base.

Unit-IV:

Design of Beams: Behavior of beam in flexure, section classification, plastic moment carrying capacity of a section, bending and shear strengths of laterally supported beams, design of laterally supported beams, deflection limits, web buckling and web crippling, design of built-up beams, design strength of laterally unsupported beams, effective lengths for lateral torsional buckling, design of laterally unsupported beams.

Textbook

- LimitState Design of Steel Structures, SK Duggal, Tata Mac-Graw-Hill Publication-2010.
- Limit-State-Design of Steel Structures by N. Subramanium, OxfordUniversity Press-2009
- Strength of Materials by B C Punmia.

References

- IS 456-2000: Code of practice for plain and R. C. BIS, New Delhi.

- I.S.800:2007,"Code for general construction in steel structures," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
- I.S.875 (part I to part V)," Code Of Practice For. Design Loads," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
- I.S.226," Steel for general structural purposes," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
- I.S.808:1989,"Code for Classification of Hot Rolled Steel ," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
- I.S.226," Steel for general structural purposes," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
- I.S.808:1989,"Code for Classification of Hot Rolled Steel ," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
- I.S.816:1969," Code of practice for use of metal arc welding for general construction in mild steel," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.

ENGINEERING HYDROLOGY
CE-604

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. understand various components of hydrological cycle
2. estimate various abstractions from precipitation such as evaporatranspiration and infiltration
3. derive relationship between rainfall and runoff using statistical techniques and plot stage-discharge relationship
4. derive unit hydrographs of different durations, and develop synthetic unit hydrographs
5. apply the technique of flood routing for the mitigation of floods in channels

COURSE CONTENTS

Unit-I:

Precipitation: Hydrologic cycle, India's water balance, World's Water balance, Types and Forms of precipitation. Measurement of precipitation. Adequacy of rain gauges. Adjustment and filling in of missing data, consistency of rainfall record. Average rainfall over an area. Frequency Analysis.

Unit-II:

Evaporation: Evaporation process and its estimation, Transpiration, Evapotranspiration, measurement of evapotranspiration- Penman, Thornwaite and Balaneycriddle methods. Evaporation Control.

Infiltration: Infiltration Process, factors affecting infiltration, measurement of infiltration, infiltration indicies

Unit-III:

Surface Runoff: Factors affecting runoff. Rainfall – runoff relationships, empirical equations. Flow duration Curve. Mass curve

Stream Gauging:Mesurement of stage, velocity. Direct and indirect methods of stream flow measurement. Rating curve, Stage discharge relationship.

Unit-IV:
Hydrograph: Factors affecting hydrograph, base flow separation. Unit hydrograph. Derivation of unit hydrograph for simple and complex storms. Unit hydrograph of different durations. Synthetic unit hydrograph.

Unit-V
Flood: Flood flow formulae, Design flood Frequency analysis using external type and log Pearson type III distribution. Flood Routing: Basic equation, Hydrologic storage routing in reservoirs and channels.

Textbook
Engineering Hydrology by K Subramanya, Tata McGraw- Hill.

References

1. Elementary Hydrology by V. P. Singh, Prentice Hall
2. Hydrology for Engineers by Linsely R. k. Tata McGraw- Hill.
3. Hand book of Applied Hydrology by V.T. Chow. Tata McGraw- Hill.

ENVIRONMENTAL ENGG - II
CE-605

L: 3 T: 1 P: 0

COURSE OUTCOMES
Upon successful completion of the course, following outcomes should be expected:

1. Student should be able to understand the importance of wastewater treatment and reuse & safe disposal
2. Students will have adequate understanding of the mechanisms of wastewater treatment
3. Students will have understanding of disposal of treated effluent and its reuse
4. Students will understand the importance of sludge treatment and its reuse
5. Students will be able to analyze and design the treatment facility and safe sludge handling

COURSE CONTENTS

Unit-I:
Wastewater Engineering: An overview; constituents in wastewater, different sources of wastewater: domestic, industrial and storm water; types of sewerage and drainage system; Estimation of wastewater flow rates and its variations: Estimation of peak, average and lean flow; drainage discharge; Hydraulics of sewers; Design of wastewater collection systems; Design of storm water drains, Rainwater harvesting system and its design

Unit-II:
Wastewater Characteristics: Physical, chemical and microbiological characteristics of wastewaters; typical characteristics of sewage: decay of sewage relative stability, population equivalent, effluent discharge standards; Eutrophication; Response of streams to biodegradable organic waste: dissolved oxygen balance and its modeling, factor affecting steam flow rejuvenation

Unit-III:

Classification of Treatment Process: Primary, secondary and tertiary treatment; types of screens and its design, assessment of head loss through screen, classification of grit chambers, its application and design, oil and grease removal; Design of primary and secondary clarifiers/ sedimentation tank; Tertiary Treatment: Polishing techniques used after secondary treatment/ effluents

Unit-IV:
Secondary/ Biological Treatment of Sewage: Theory of biological treatment: Microbial growth kinetics, suspended and attached growth systems: Aerobic Treatment - Activated Sludge Process and its modifications, Trickling Filter/ Bio Towers and Rotating Biological contractors; Anaerobic Treatment - Upflow Anaerobic Sludge Blanket Process

Unit-V:
Sludge Management and its Disposal: Regulation for reuse and disposal of solids; Sudge thickening and its digestion; Low cost sanitation: decentralized wastewater treatment - stabilization ponds, aerated lagoons, oxidation ditch; Reuse of treated effluents; Concepts of zero discharge

Books

1. Environmental Engineering, Peavy, Rowe & Tchobanoglobus, McGraw Hill
2. Introduction to Environmental Engineering, Davis & Cornwell, McGraw Hill
3. Wastewater Engineering Treatment & Reuse, Metcalf & Eddy, McGraw Hill, USA
4. Environmental Engineering- A design Approach ,Sincero & Sincero, Prentice Hall of India
5. Wastewater Treatment Plants: Planning, Designing and Operation, S.R.Qasim, CRC Press, USA
6. Wastewater Treatment for Pollution Control and Reuse, Soli J. Arceivala & Asolekar, Tata McGraw Hill, India
7. Post Treatment of Anaerobically Treated Effluents, V.K.Tyagi, Abid Ali Khan, Anwar Khursheed, A.A.Kazmi, Ng Wun Jern, IWA Publishing, UK

SEMESTER VII

FOUNDATION ENGINEERING
CE-701

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand the importance of Foundation Engineering.
2. have adequate understandings of foundation and load transfer to the sub soils at shallow depth.
3. design deep foundation, Pile foundation, Well foundation.
4. gain competent knowledge about earth pressure theory as well as introductory soil dynamic concept.
5. analyse for the static and dynamic load on machine foundations.

COURSE CONTENTS

Unit-I: Retaining Structures

Introduction to Coulomb's earth pressure theory for cohesive and granular soil, graphical methods.

Classification of earth retaining structures (Rigid and Flexible). Analysis & Design of Sheet pile walls, bulkheads, and anchored sheet pile.

Unit -II: Soil Investigation and Bearing Capacity
Purpose, extent, and methods of site investigation; Boring and sampling techniques, Samplers, Boring records; Plate load test; Penetration tests; Introduction to Geophysical methods. Introduction to foundation & bearing capacity of soils; load-settlement curve; types of shear failures of foundation soils;Terzaghi's and Meyerhof's bearing capacity Theories; effect of water table fluctuations, shape, size, depth of footing, andinclination of loading.

Unit- III: Shallow Foundations
Types and general requirements of shallow foundation; Bearing capacity consideration, settlements of foundations, I.S. Code recommendations. (I.S. 6403, 8009). Design of shallow foundations.

Unit- IV: Deep Foundations
Types, purpose and classification of pile foundations: Construction of piles, pile load test, load capacity and settlement of piles;Design of Pile foundations, use of relevant I.S. Code (I.S. 2911: Part I-IV); Well foundation: Types, element and construction well foundation, principles of design.

Unit- V: Soil Dynamics & Machine Foundations
Introduction to soil dynamic, definitions, spring mass system, single degree of freedom system, free and forced vibration of damped and undamped systems; Types & criteria for design of machine foundations. Analysis and design of block foundation; Vibration isolation (active and passive method).

Textbook

1. Design of foundation and Retaining Structures By S. Prakash, G Ranjan & S Saran; Sarita Pracashan, Meerut
2. Soil Dynamics By Shamsher Prakash; McGra Hill, London
3. Soil Mechanics and Foundations By B C Punmia & Ashok Kumar Jain; Laxmi Publications, Delhi
4. Environmental Engineering – A Design Approach, Sincero & Sincero, Prentice Hall of India

References

1. Basic and applied soil mechanics, Gopal Ranjan and Rao A.S.R., New Age International Publishers
2. Geotechnical Engineering, Venkatramiah, New Age International Publishers
3. Geotechnical Engineering, Shashi K. Gulhati and Manoj Dutta, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Foundation Engineering, Leonards G.A., McGraw Hill
5. Foundation Design, Teng W.C., PHI

DESIGN OF STRUCTURES
CE-702

L: 3 T: 1 P: 0

COURSE OUTCOMES
Upon successful completion of the course a student should be able to:
1. assess the load criteria and design of RCC slab and staircases.
2. design reinforced concrete short and long columns subjected to uni-axial and bi-axial

compression.

3. select the most suitable section shape and size for Plate girder and design according to specific design criteria.
4. analyse and design roof trusses & estimation of wind load. Design of gantry girder for different loading combinations.

COURSE CONTENTS

Unit-I:

Design of slabs and stairs: Various type of slabs and their behavior, design of two- way rectangular slabs with different boundary conditions, use of moment coefficients, provision for corner reinforcement; Design of stairs.

Unit-II:

Design of Columns: Columns, various cross sections, effective length, slenderness ratio, short and long columns, design of columns under axial compression, uni-axial and bi-axial compressions, uses of interaction curves ofSP16 for column design.

Unit-III:

Plate girder: Elements of plate girder, self weight of plate girder, economical depth, size of flanges, shear buckling resistance of web, end panel design, anchor forces, design of connections between flanges and web plates, design of bearing and intermediate stiffeners, and their connections with web; Design of plate girders.

Unit-IV:

Roof Trusses: Types of roof trusses, loads on trusses:wind load estimation, snow load, live load and load combinations,bracings, spacing of trusses, purlins, sheetings, analysis of trusses, grouping of members, design of members, bolted joints and end bearings.

Gantry Girder: Loads for gantry girders, position of moving load for maximum effect, profile of gantry girders, limitation on vertical deflection, design procedure of gantry girder.

Textbook

1. Limit State Design of Steel Structures, SK Duggal.Tata Mac-Graw-Hill Publication-2010.
2. Limit-State-Design of Steel Structures by N.Subramanium-2009, Oxford University Press.
3. Limit State Design of Concrete Structures by Verghees, Vol. 1.

References

1. Reinforced Concrete Design, by S U Pillai and Devdas Menon, Tata-McGraw-Hill
2. Publishing Company Limited, New Delhi.
3. Comprehensive Design of RCC Structures, by B C Punmia, A K Jain and A K Jain, Laxmi Publications (P) Ltd, New Delhi
4. Design of Reinforced Concrete Structures, by SRamamrutham, Dhanpat Rai
5. Publishing Company, New delhi,
6. Limit State Theory and design of reinforced Concrete, by V L Shah and
7. S R Karve, Structures Publications, Pune, 2011
8. Reinforced Concrete Structures, by Park R and Paulay T, John Wiley & Sons, Inc.,
9. New York, 1975
10. IS 456: 2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi

WATER RESOURCES ENGINEERING
CE 703

L: 3T: 1 P: 0

COURSE OUTCOMES

1. Apply the concept of sustainable development to the management of water resources projects
2. Analyze water resource systems using linear and dynamic programming, and conduct financial analysis of projects
3. Analyze and design components of flood control infrastructure with environmental and societal considerations
4. Identify, formulate, analyze, and solve problems related to hydropower production
5. Apply appropriate techniques for the analysis and design of complex river training works

COURSE CONTENTS

Unit-I:
Water resources of India, global water resources, surface and ground water resources, multipurpose uses of water purposes served by water resources development projects, impact of climate change on water resources, single and multipurpose projects, consumptive, non-consumptive, and partial consumptive use, firm yield, secondary yield, estimation of reservoir yield and storage capacity of reservoirs

Unit-II:
Sediment transport: Mechanism of sediment transport, sediment load, bed load, suspended load, reservoir sedimentation, trap efficiency, capacity-inflow ratio, measures for control of reservoir sedimentation, estimation of useful life of reservoir

Unit-III:
Floods and their management, Probable maximum flood, standard project flood, flood estimation techniques, classification of methods of flood control, flood plain management, flood damages, methods for estimation of flood damages, national policy on flood control

Unit-IV:
General arrangement of hydroelectric projects, hydropower development of India and the world, major hydroelectric projects in India, comparison with thermal and nuclear plants, environmental issues related to hydropower production, firm and secondary power, power duration curves, reliability of hydropower production, illustrative examples

Unit-V:
River morphology; classification of rivers and river training works, methods of river training works, marginal embankments, guide bunds, groynes, cutoffs, bank pitching and launching aprons, design of guide bunds.

Text Books:

1. Water Resources Engineering, R. K. Linsley et al.
2. Water Resources Engineering, Larry W Mays
3. Water Resources Engineering, S K Garg
4. Water Resources Engineering, P. N. Modi

Reference Books

1. Water Resources Engineering, Ralph A. Wurbs, Wesley P. James, Prentice Hall
2. Applied Hydrology, V. T. Chow et al.
3. Water Resources Systems Planning and Management“,Chaturvedi, M.C. Tata McGraw HillPub. Co., N Delhi
4. Water Resources Systems“,Hall. W.A. and Dracup, Tata McGraw Hill Pub. N Delhi

ENGINEERING ECONOMY& CONSTRUCTION MANAGEMENT
CE-704

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand and calculate economic equivalence and to be able to Identify and use some Excel functions commonly applied in engineering economics.
2. evaluate most engineering project proposals using a well-accepted economic analysis techniques.
3. understand structure of construction organization and its functions, labour laws and to be able to understand the use and selection of construction equipment
4. understand the use of basic network technique of PERT in construction management.
5. understand the use of basic network technique of CPM in construction management.

COURSE CONTENTS

Unit-I:

Basic concepts of engineering economics, cash flow diagram, minimum attractive rate of return, single payment, uniform series and gradient series factors – their derivation and use, nominal and effective interest rates, use of multiple factors, depreciation and depletion, present worth comparison of equal and different lived alternatives**.**

Unit-II:

Capitalized cost calculation, annual worth (AW) evaluation using salvage sinking fund, salvage present worth and capital recovery plus interest method, comparing alternatives by AW, rate of return evaluation by present worth and AW method, benefit/ cost ratio analysis

Unit-III:

Overview of construction industry, structure of construction organization and its functions, management functions and responsibilities, labour relations, construction equipment: power shovel hoe, bulldozer, dumper, trailers, and tractors, rollers, sheep foot roller, batching plants.

Unit-IV:

Planning, scheduling , basic network techniques, Gantt charts, PERT Network, time estimates, probability distribution, time computations, earliest expected time, latest allowable occurrence time, network analysis, slack, critical path.

Unit-V:

CPM network, floats, crashing a network, introduction to precedence networks.

Textbooks

1. Engineering Economy by Leland T. Blank, Anthony J. Tarquin, McGraw-Hill Book Company, New Delhi.
2. PERT and CPM by L.S.Srinath ,Affilated East-West Press Pvt. Ltd, New Delhi.

References

1. Construction Planning, Equipment and Methods by Robert L. Peurifoy, William B. Ledbetter, Clifford J. Schexnayder, McGraw-Hill Book Company, New Delhi.
2. Fundamentals of Construction Management and Organization by Kwaku A. Tenah Jose M. Guevara Reston Publication Co., Inc.,A Prentice-Hall Company Reston, Virginia

3. Construction Planning, Equipment and Methods by Robert L. Peurifoy, William B. Ledbetter, Clifford J. Schexnayder, McGraw-Hill Book Company, New Delhi.C

SYLLABUS FOR ELECTIVES

ADVANCE TRANSPORTATION ENGINEERING
CE-711

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. build concept in different means of public and private transportation, sustainability and design of public transit network .
2. understand basic concepts, analysis and design of railway track.
3. understand basic concepts, analysis and design of railway track geometrics, stations, yards, signaling and metro railway.
4. analyse and design aspects of airports, runway, taxiway and air traffic control.
5. understand basic concepts of water transportation and bridge engineering.

COURSE CONTENTS

Unit-I

Urban transportation problems, Transportation and urban growth, Mass transit system, Comparison of different transit modes, Transit and environment, Transit and urban sustainability, Route design and scheduling of transit system.

Unit-II:

Introduction of railways, Railway Track, gauge, Track components – Rail, rail fittings, fixtures, Sleepers and ballast requirements and specification per kilometer of track, Formation and cross-section details, drainage, track defects.

Unit-III:

Geometric design of track, Points and Crossing, Station and Yards, Level crossing, Signaling and control, Suburban Railways, Metro railways system, Modernization of railways, Underground Railways and Tunneling.

Unit-IV:

Aircraft Characteristics, airport planning, site selection and configuration, Obstruction and zoning, Runway and taxiway design, Basic runway length and corrections, geometric design elements, Visual aids – marking and lighting, air traffic control and aids, Airport capacity.

Unit-V:

Sea Port, Harbors, Types and selection of site, Break-waters, Jetties, Wharves. Navigation aids: Buoys and light houses, Inland water transportation.
Components and classification of bridges, site investigation, waterway design.

Textbook

- Urban Mass Transportation Planning, A. Black, McGraw Hill.
- Railway Engineering by Chandra and Agarwal, Oxford University Press.
- Railway Engineering by Saxena and Arora, Dhanpat Rai Publications.

- Air Transportation Planning and Design by Saxena, CBS Publisher.

References

1. Planning and Design of Airports by Horonjeff and McKelvey, McGraw Hill.
2. Dock and Harbour Engineering, Oza and Oza, Charotar Publisher.
3. Bridge Engineering, Ponnuswamy, Tata McGraw Hill.

ARCHITECTURE AND TOWN PLANNING
CE712

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand the brief history and basic principle of architecture.
2. understand basic architectural design.
3. apply the basic concepts of town planning.
4. implement the concept of land use and town planning.
5. understand master plan and its implications.

COURSE CONTENTS

Unit-I:

Brief history of Architecture, Egyptian, Greek, Roman and Indian architecture. Evolution of various structural forms. Impact of materials on building forms and construction techniques.

Unit-II:

Philosophy of architectural design: scale, form, texture, balance, skyline, unity, harmony, contrast, proportion. Colour in architecture, site selection and orientation of residential buildings.

Unit –III:

Evolution of human settlements: Factors and Forces. Utopian concepts of city planning: garden city, vertical city, broad acre city, linear city, Super Block and neighbourhood unit concepts.

Unit-IV:

Concepts for spatial arrangement of land uses: concentric zone, sector and multiplenuclei concepts, and their applicability to Indian conditions Density in residential and non-residential areas. Land use classification system. Surveys for town planning.

Unit-V:

Master plans; case studies: one for a new town plan and one for master plan of an existing city. Zoning and sub-division regulations and building byelaws. Agencies for implementation of master plans. Public participation. Problem of slums. Approaches for environmental improvement of slums.

Books:

1. A history of Architecture by Sir Banister Flechure.
2. A General History of Architecture by Bruce All Sopp.
3. Architecture by John Gloag.
4. The principles of Architecture Composition by Howard Robertson.
5. Indian Architecture by Percy Brown.

6. The Urban Pattern. City Planing and Design by Arthur B. Galion and Simon Eisner.

EARTHQUAKE RESISTANT DESIGN
CE 713

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand the concept of strong seismic motion and dynamics of structure.
2. understand the effects and behaviour of structures under earthquake.
3. gain adequate knowledge on seismic terminology and lateral forces on structures
4. learn ductile detailing of RCC structures, earthquake resistant design of masonry buildings as well as retrofitting

COURSE CONTENTS

Unit – I:

Strong motions and Dynamics of Structure:Strong motions, Introduction, Terminology of Strong Motion, Nature of Ground Motion: source effect, Path effect, site effect. Amplitude, peak ground acceleration, vertical acceleration, seismometer and other seismic instruments.

Dynamics of Structure, modelling of Structure, lumped mass approach, equation of Motion, mathematical and structural modelling, System of Multiple Degrees of Freedom, Responses Spectrum.

Unit – II:

Effects and Behavior of structures under Earthquake: Introduction, Natural time period of site and structure, Liquefaction of soil, Restoring force, Damping, Effects of Structural Irregularities (vertical, plan and mass). Seismoresistant Building Architecture, Building Characteristics. Introduction of IS 1893:2002, Design Philosophy, Use of IS 1893:2002 and Determination of Design Lateral Forces: Equivalent Static Lateral force Method.

Unit – III:

Determination of Lateral Forces: Use of IS 1893:2002, Determination of Design Lateral Forces: Response Spectrum Method, Time History Method.(eigen values and eigen vectors, modal participation factors, modal mass, Use of ABS, SRSS, CQC methods)

Unit – IV:

Ductile detailing of RCC Structures, Earthquake Resistant Design of Masonry Buildings and Retrofitting: Ductility Considerations: Introduction, Assessment of Ductility, Factors Affecting Ductility, Ductility Factors, Ductile Detailing as per Use of IS 13920: 1993, Load transfer mechanism of joints

Earthquake Resistant Design of Masonry Buildings and Retrofitting: Behavior of masonry building under earthquake, lateral Load Analysis of Masonry Buildings. Design of brick masonry wall under vertical and laterals loads, concepts of Repair, Restoration and Strengthening of existing buildings, Methods of Retrofitting

Books:

1. Earthquake Resistant Design of Structures by Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.

2. Elements of Structural Dynamics by Glen V. Berg, Prentice Hall Englewood Cliffs, New Jersey
3. Dynamics of Structures by Anil K. Chopra, Pearson Education
4. Geotechnical Earthquake Engineering by Steven L. Kramer, Pearson Education

SEMESTER VIII

IRRIGATION ENGINEERING
CE801

L: 3 P: 1 T: 0

COURSE OUTCOME

Upon the completion of course, students will be able to

1. underline the irrigation needs and planning ;
2. estimate water requirements of crops and irrigation water requirements;
3. design the canal system and identify the needs of various hydraulic structures;
4. analyze the subsurface flow and be able to design weir, canal falls, cross drainage works;
5. assess the remedial measures for water logging and design of lined canal.

COURSE CONTENTS

Unit- I:

Irrigation in India – Necessity, scope of irrigation, irrigation schemes, ongoing projects, engineering aspects of project planning; Water application – crop types, water requirements and its estimation, water application efficiencies and techniques of field irrigation.

Unit – II:

Design of Alluvium Channels, Silt theories – problems of silting and scouring, Kennedy's theory, design procedure, drawbacks, Lacey's silt theory, channel design procedure, drawbacks, Comparison between Kennedy's and Lacey's theory, Lacey's non-regime equation, L-section of a channel, balancing depth, Use of Garret's diagram, Cross-section of irrigation channels.

Unit – III:

Weirs and barrages – components, functions, causes of failure; Bligh's creep theory, Lanes's weighted creep theory, Khosla's theory, pressure calculations, Design – sloping glacis weir and protection works.

Unit – IV:

Water logging – effects of water logging, causes of water logging and their remedial measures. Canal lining – advantages, types of lining, and design of lined channels. Regulation works. Canal falls, types of falls, Design of Sarda type fall.

Unit V:

Cross-Drainage works, Types of works, factors affecting the suitability of CD works, classifications of aqueducts and siphon aqueducts, Design- maximum flood discharge, water way, transitions, head losses, uplift pressures etc.

Text Books

1. Irrigation, Water Resources and Power Engineering by P.N. Modi , Standard Book House, Delhi , Latest edition.
2. Irrigation Engineering and Hydraulic Structures by S.K. Garg, Khanna Publishers, Lates edition

Reference Book

1. Irrigation and Water Resources Engineering by G.L. Asawa, New Age International Publishers
2. Theory and Design of Irrigation Structures by By Varshney and Gupta, Vol. I and II,
3. Hydraulic Structures by Novak, P. , AIB Moffat and Nalluri and R Narayanan, Taylor and Francis
4. NPTEL

SYLLABUS FOR ELECTIVES

CONSTRUCTION PROJECT MANAGEMENT
CE-805

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand basic concepts of project management, project organization, and estimate project cost for the client
2. use construction planning and application of computers in scheduling and resource leveling
3. evaluate project cost and bidding strategy and management of resources.
4. apply basic concepts of project cost and risk in construction and project monitoring

COURSE CONTENTS

Unit-I:

Basic concepts of project management, project organization, client's estimation of project cost, construction contract

Unit-II:

Construction planning: Ladder network, precedence network, the line of balance, network technique advantages, Project scheduling and resource levelling, network crashing and cost-time trade-off. Computer applications in scheduling and resource levelling.

Unit-III:

Contractor's estimation of cost and bidding strategy, Construction equipment management, Construction material management.

Unit-IV:

Project cost and value management, risk in construction, Project monitoring and control system. Computer applications in Monitoring and reporting, construction quality management, construction safety management

Textbooks

1. Construction Project Management, Theory and Practice by Kumar NeerajJha, Pearson

Education, New Delhi.
2. Scheduling Construction Projects by Sanra Christian Weber, Pearson Education, New Delhi.

References

1. Peter Fewings, “Construction Project Management”, Taylor and Francis,U.K.
2. Peurifoy, R.L., Ledbetter, W.B.andSchexnayder, C., " Construction Planning,Equipment and Methods ", 5th Edition, McGraw Hill, Singapore, 1995.
3. Sharma S.C. " Construction Equipment and Management ", Khanna Publishers New Delhi, 1988.
4. Deodhar, S.V. " Construction Equipment and Job Planning ", Khanna Publishers, New Delhi, 1988.
5. Dr. Mahesh Varma, " Construction Equipment and its Planning and Application ",Metro-politan Book Company, New Delhi-, 1983.
6. Prasanna Chandra, " Pojects-Planning Analysis Selection Implementation & Review Fourth Edition ",Tata Mc Graw Hill Publishing Co., Ltd., New Delhi., 1995.
7. Joy.P.K.,, " Total Project Management - The Indian Context (Chapters 3- 7) ", New Delhi ,Macmillan India Ltd., 1992.
8. United Nations Industrial Development Organisation (UNIDO) " Manual for the preparation of Industrial Feasibility Studies ", (IDBI Reproduction) Bombay, 1987.

ADVANCE STRUCTURAL DESIGN
CE-807

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. design different types of footings and retaining walls
2. design different types of water tanks
3. design different types of bridges and culverts
4. analyse and design prestressed concrete structures

COURSE CONTENTS

Unit-I:

Foundation and their types**:** Detailed design of Isolated and combined footing, design of wall footings. Retaining walls: Cantilever and Counter fort type, their design using limit state method.

Unit-II:

Water tanks: Design criteria, material specifications and permissible stresses; IS 3370 (Pt. 1, Pt.2, Pt. IV) 2009; Design of circular and rectangular water tanks resting on ground & underground using working stress approach, cracking width in immature concrete and mature concrete in flexure and direct tension.

Unit-III:

Bridges: Introduction, various types, super-structures, sub-structures, IRC loadings; Design of deck slab; Design of T-beam Bridge. Introduction to prestress concrete bridge.

Unit-IV:

Prestressed concrete: Methods and systems, anchorages, prestress losses, analysis and design of sections for flexure based on working stress.

Textbook

1. Pillai S. Unnikrishna and Menon Devdas, Reinforced Concrete Design, McGraw-Hill, 3rd edition, 2015.

References

1. Lin, T.Y. and Burns H. Ned, Design of Prestressed Concrete Structures, Wiley, 2012
2. Victor D. J. 5th Edition, Essentials of Bridge Engineering, Wiley, 2006
3. Raju N. Krishna, Design of Reinforced Concrete Structures, CBS Publishers and Distributers Pvt Ltd, 4th ed., 2016
4. Sharma N., Reinforced Cement Concrete Design, Katson Books, 2014.

ADVANCE ENVIRONMENTAL ENGINEERING
CE-808

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand the significance of air pollution and its impact identification
2. analyze and solve problems of air pollutants dispersion
3. design solutions for air pollution control devices
4. identify, formulate, and analyse problems related to solid waste and its management
5. analyze the impacts of projects on environment and its management plan

COURSE CONTENTS

Unit-I:

Air pollution: Meteorology, plume rise, plume behavior, dispersion of pollutants, factors affecting dispersion, Gaussian dispersion model, assumptions, applications and limitations.

Unit-II:

Introduction to air pollution control devices: Particulate and gaseous contaminants, constructional features, working principle, design of control devices for particulate and gaseous contaminants.

Unit-III:

Solid wastes: Physical and chemical characteristics of solid waste, generation, collection and disposal of solid waste, land filling operations.

Unit-IV:

Noise pollution: Definition, fundamental concepts, sources and effects of noise, measurement techniques, noise pollution control and current standards.

Unit-V:

Introduction to environmental impact assessment: Objectives, attributes of EIA, different techniques of EIA, impact assessment and environmental management plan.

Text Books

1. Environmental Pollution Control engineering by CS Rao, Published by Wiley Science
2. Air Pollution: Its Origin And Control by Wark Kenneth Jr. , Wayne T. Davis, Cecil F. Warner Printice Hall
3. Air Pollution Control Engineering, 2nd Edition by Neol De Nevers, Mc Graw Hill
4. Environmental Engineering, Howard S Peavy , Donald R Rowe , George Tchobanoglows, Published by Tata McGraw-Hill, New Delhi

References

1. Textbook Of Noise Pollution And Its Control by S.C. Bhatia, Atlantic Publisher
2. Introduction To Environmental Engineering And Science by Glibert M. Masters published By Dorling Kinderslay India
3. Environmental Impact Assessment by PR Trivedi, PHP Publisher
4. An Introduction to Ecology and Environmental Science by P.C. Prabhu, C. Udayasoorian, G. Balasubramanian by Abhijit Publications

GROUND WATER ENGINEERING
CE809

L: 4 T: 0 P: 0

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. learn different terminologies related with groundwater hydrology.
2. learn techniques of groundwater balance.
3. understand the principle and design of rain water harvesting structures.
4. understand the techniques of drilling techniques.

COURSE CONTENTS

Unit-1:

Hydrologic Cycle , Concept of Groundwater in Hydrologic Cycle, Sub Surface Strata Analysis as Aquiclude, Aquitord , aquifuge and Aquifers Explanation of Unconfined, semi –confined and Confined Aquifers, Perched Aquifers. Geophysical methods for Groundwater Exploration , Resistivity System, Application of Schlumberger and Wenner's configurations.

Unit-II:

Groundwater Balance Study. Concept of Gross Recharge, Recoverable recharge , Draft and Status of Groundwater Analysis using NABARD's Norms and Local Norms . Numerical problems on Groundwater balance Equation and Status of Groundwater Stage of development. Analysis of Categories of Groundwater as White Category,Grey and Black Category.

Unit-III:

Principle and Definition of Rainwater Harvesting. Classification and Determination of Rainwater Harvesting. Numerical Problems on Rainwater Harvesting. Feasibility and Design of Rainwater Harvesting. Case Study on Rainwater Harvesting.

Unit-IV:

Introduction of Drilling techniques. Drilling in Alluvium and Soft Rock area, Reverse Rotary Drilling and Direct Rotary drilling methods,Calayx method, Driiling in Hard Rock area, DTH method and Woodex Method, Percussion Drilling. Geophysical Logging and Tube well design.

Reference books:

1. Groundwater Hydrology: Devid Keith Todd,
2. Hydrogeology : K.R. Karanth
3. Groundwater : H. M. Ragunath

Structure of Curriculum for 2017 scheme

Semester I

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
AS-101	Communication Skills	3	0	0	3	3
AS-102	Engineering Physics I	2	1	0	3	3
AS-103	Engineering Chemistry I	2	1	0	3	3
AS-104	Engineering Maths I	3	1	0	4	4
CE-101	Basics of Civil Engineering& Environmental Engineering	2	1	0	3	3
ME-101	Basics of Mechanical Engineering	2	1	0	3	3
EE-101	Basics of Electrical Engineering	2	1	0	3	3
AS-151	Language Lab	0	0	2	2	1
AS-152	Engineering Physics Lab I	0	0	2	2	1
AS-153	Engineering Chemistry Lab I	0	0	2	2	1
ME-151	Workshop	0	0	4	4	2
ME-102	Engineering Mechanics Lab	0	0	2	2	1

Semester II

AS-201	Human Resource Management	3	0	0	3	3
AS-202	Engineering Physics II	2	1	0	3	3
AS-203	Engineering Chemistry II	2	1	0	3	3
AS-204	Engineering Mathematics II	3	1	0	4	4
EC-101	Basics of Electronics Engineering	3	0	0	3	3
FC-101	Fundamentals of Computing	2	1	0	3	3
AS-105	Innovative Science & Technology	3	1	0	4	4
ME-250	Engineering Graphics	0	0	4	4	2
AS-252	Engineering Physics Lab II	0	0	2	2	1
AS-253	Engineering Chemistry Lab II	0	0	2	2	1

Semester III

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-301	Solid Mechanics	2	1	0	3	3
CE-302	Fluid Mechanics	2	1	0	3	3
CE-303	Civil Engineering Materials	3	0	0	3	3
CE-304	Surveying	3	0	0	3	3
CE-305	Engineering Geology	3	0	0	3	3
AS-301	Engineering Maths III	3	1	0	4	4
CE-351	Solid Mechanics Lab	0	0	2	2	1
CE-352	Fluid Mechanics Lab	0	0	2	2	1
CE-353	Civil Engineering Materials Lab	0	0	2	2	1
CE-354	Surveying Lab	0	0	2	2	1
CE-355	Engineering Geology Lab	0	0	2	2	1

Semester IV

CE-401	Structural Analysis I	2	1	0	3	3
CE-402	Hydraulics	2	1	0	3	3
CE-403	Building Construction	3	0	0	3	3
CE-404	Geometrics	2	1	0	3	3
CE-405	Estimating and Costing	3	0	0	3	3
CE-410	Numerical Analysis and Computer Programming	3	1	0	4	4
CE-451	Structural Analysis Lab	0	0	2	2	1
CE-452	Hydraulics Lab	0	0	2	2	1
CE-453	Civil Engineering Drawing	0	0	4	4	2
CE-454	Geometrics Lab	0	0	2	2	1
CE-460	Computer Lab	0	0	2	2	1

Semester V

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-501	Structural Analysis II	2	1	0	3	3
CE-502	Design of Structure I	3	0	0	3	3
CE-503	Design of Structure II	3	0	0	3	3
CE-504	Open Channel Flow	2	1	0	3	3
CE-505	Soil Mechanics	3	1	0	4	4
CE-506	Environmental Engineering I	2	1	0	3	3
CE-552	Design of Structure I Lab	0	0	2	2	1
CE-553	Design of Structure II Lab	0	0	2	2	1
CE-555	Soil Mechanics Lab	0	0	2	2	1
CE-556	Environmental Engineering Lab I	0	0	2	2	1
CE-557	Survey Camp	0	0	2	2	1

Semester VI

CE-601	Structural Analysis III	2	1	0	3	3
CE-602	Design of Structure III	2	1	0	3	3
CE-603	Engineering Hydrology	2	1	0	3	3
CE-604	Geotechnical Engineering	2	1	0	3	3
CE-605	Environmental Engineering II	3	0	0	3	3
CE-606	Transportation Engineering I	3	0	0	3	3
CE-655	Environmental Engineering Lab II	0	0	2	2	1
CE-666	Transportation Engineering Lab	0	0	2	2	1
CE-667	Software Lab	0	0	2	2	1

Semester VII

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-701	Design of Structure IV	2	1	0	3	3
CE-702	Irrigation Engineering	3	0	0	3	3
CE-703	Foundation Engineering	3	0	0	3	3
CE-704	Engineering Economics & Construction Management	3	1	0	4	4
CE-705	Environmental Engineering III	2	1	0	3	3
CE-706	Transportation Engineering II	2	1	0	3	3
CE-751	Advance Structural Design Lab	0	0	2	2	1
CE-754	Cons Management Lab	0	0	2	2	1
CE-757	Summer Practical Training	0	0	2	2	1
CE-760	Project	0	0	8	8	4

Semester VIII

CE-801	Elective-I	3	1	0	4	4
CE-802	Elective-II	2	1	0	3	3
CE-803	Elective-III	2	1	0	3	3
CE-850	Seminar	0	0	2	2	1
CE-860	Project	0	0	16	16	8
Total		**116**	**33**	**90**	**239**	**194**

BACHELOR OF TECHNOLOGY

(B. TECH.)

Civil Engineering

SYLLABUS

Effective From

2017-18

Department of Civil Engineering
Faculty of Engineering & Technology
Jamia Millia Islamia
New Delhi-110025
www.jmi.ac.in

SYLLABUS

OF

BACHELOR OF TECHNOLOGY

(B. TECH.)

Effective From

2017-18

Department of Civil Engineering
Faculty of Engineering & Technology
Jamia Millia Islamia
New Delhi-110025

Preface

The revision of the curriculum is a continuous process. The program curriculum has been modified in consultations with all the stakeholders while keeping the vision and mission statements of the department as the guiding principle. The old curriculum is reviewed in the light of program objectives (POs) set forth by the NBA and Program Specific Objectives (PSOs) formulated by the department to identify the gaps and maintain the balance in the composition of basic and engineering sciences, humanities/ management, professional courses and their distributions in core and electives along with seminars/internships and projects. A broad framework was formed for distribution of courses for various specialisations in the light of Model Scheme of Instructions and Syllabi for UG Civil Engineering Degree proposed by AICTE New Delhi. The program curriculum of reputed institutes like IITs, NITs etc. were obtained and compared with our curriculum. The syllabi of Indian Engineering Services (IES) of UPSC and GATE were collected, and incorporated in the department curriculum. Feedback from stakeholders e.g. alumni, students, parents, industry and employers was obtained. Committees were formed and duties were assigned to faculty members to prepare the syllabi of each course for different specialisations such as structural engineering, hydraulics and water resources engineering, environmental engineering, geotechnical engineering, transportation engineering and geomatics. I wish to acknowledge the hard work put in by the faculty members and stakeholders in the updating and revision of curriculum. I also wish to convey my sincere thanks to the subject experts who gave their valuable inputs in finalizing this syllabus.

(Prof. Gauhar Mahmood)
HOD, Civil Engineering

Department of Civil Engineering: A Brief Overview

The department of Civil Engineering is one of the oldest and the largest department in the Faculty of Engineering & Technology. The department has produced several eminent engineers who have made important contributions in the planning and execution of many important civil engineering projects in India as well as abroad.

The department offers B. Tech. course in Civil Engineering. The department also offers Master's programme with specialisations in Environmental Engineering and Earthquake Engineering. These courses are supported with strong doctoral programmes in all the major specialisations of Civil Engineering. The department is known for its reputed faculty with expertise in diverse fields. Presently, the department has 22 highly qualified, experienced and dedicated faculty members, actively participating in research and consultancy work. The department has established a state of the art experimental facilities and laboratories in different fields of civil engineering. It has received the prestigious funding under FIST from DST and SAP from UGC.

The faculty also renders technical advice on live engineering problems to various government and private sector companies throughout the country. These live projects are effectively used as training desk for our students at undergraduate and postgraduate levels. RITES, Military Engineering Services, Municipal Corporations of Delhi, Faridabad, Gurgaon, Gaziabad, NOIDA, PWD, CPWD, DDA, HUDA, Jal Nigam etc. regularly hire services for technical advice and vetting of designs of infrastructure projects.

International and national conferences, seminars and special lectures are a regular feature of the department to impart education and training. The department has active collaboration with academics and industry such as University of Applied Sciences Erfurt (Germany), Wessex Institute (UK), University of Waterloo (Canada), Asian Institute of Technology (Bangkok) and Steel Authority of India (INDIA).

Leading MNCs and public sectors are regular recruiter of our students and many students have been selected in Engineering Services. Large numbers of students qualify the GATE examination with good ranks to go for higher studies. Several of our alumni pursued higher education in foreign countries like USA, UK, Germany, Canada, Australia and France and have been appointed as faculty members and consultants abroad.The department strongly believes in continuous efforts to strive for excellence by exploring new frontiers of knowledge, imparting the latest technical knowledge to the students and conducting high quality research. The department has formulated the curriculum for the B. Tech. program in consultation with various stake holders keeping in mind the current industry practices and future scenarios in civil engineering.

FACULTY OF ENGINEERING & TECHNOLOGY
JAMIA MILLIA ISLAMIA, NEW DELHI

VISION

To become a leading engineering institute through knowledge creation, acquisition and dissemination for the benefit of society and industry.

MISSION

1. To develop a center of excellence by imparting quality education to produce technically sound and research oriented professionals to face the emerging challenges of society and industry.
2. To enhance knowledge by innovative teaching, engaging in cutting edge research and developing linkage with industry.
3. To impart ethical, social and environmental values to produce competent engineers for the service of mankind.
4. To inculcate technological capabilities through continuous interaction with academia and industry in emerging areas for sustainable development.

DEPARTMENT OF CIVIL ENGINEERING

VISION

To emerge as center of excellence for education and research in Civil Engineering and to produce professionally competent and ethically sound engineers of global standards, ready to serve the community and the nation with dedication.

MISSION

M.1 To provide rigorous hands on civil engineering education through learner centric teaching pedagogy.
M.2 Establish state-of-the art facilities for teaching and research in civil engineering domain.
M.3 Motivate students to develop low-cost and sustainable ethical solutions to problems faced by the society.
M.4 Provide opportunities to students to enable them to develop leadership and interpersonal skills.

Programme Educational Objectives (PEOs)

The department of civil engineering in consultation with stake holders has formulated Programme Educational Objectives (PEOs) that are broad statements describing the career and professional accomplishment that the programme is preparing its graduates to achieve in few years, subsequent upon to receiving the degree. The PEOs of B. Tech. program in civil engineering are as follows:

1. Graduates shall apply professional skills for successful careers dealing with analysis, design and management of infrastructural projects, both in India and abroad.
2. Graduates shall use civil engineering concepts so as to formulate, analyse and solve civil engineering and allied problems using the principle of mathematics and science.
3. Graduates shall deliver a comprehensive and balanced understanding of several branches of civil engineering such as structural engineering, geotechnical engineering, transportation engineering, hydraulic and water resources engineering, environmental engineering and interdisciplinary areas.
4. Graduates shall demonstrate high ethical standards, effective oral and written communication skills, and ability to work as part of teams on multidisciplinary projects in diverse professional environments, and should be able to relate engineering issues to the society and nation.
5. Graduates shall acquire academic excellence, leadership and management skills, and engage in life-long learning to be successful in professional and entrepreneurial world.

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and Write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Upon successful completion of the Bachelor of Technology Program in Civil Engineering, the students should be able to:

PSO1: Analysis and design of foundations and superstructures for residential and commercial buildings using commercial software

PSO2: Design of hydraulic structures, highways, railways, airways, docks and harbors

PSO3: Design, test and evaluate water, sewerage and industrial effluent conveying and treatment systems

PSO4: Survey, map and plan layouts for buildings, roads, and hydraulic structures using modern tools such as the total station

COURSE STRUCTURE

B. Tech. (Civil)

Semester I

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
AS-101	Communication Skills	3	--	--	3	3
AS-151	Language Lab	--	--	2	2	1
AS-102	Engineering Physics - I	2	1	--	3	3
AS-152	Engineering Physics Lab. - I	--	--	2	2	1
AS-103	Engineering Chemistry - I	2	1	--	3	3
AS-153	Engineering Chemistry Lab. - I	--	--	2	2	1
AS-104	Engineering Maths - I	3	1	--	4	4
CE-101	Basics of Civil Engineering	2	1	--	3	3
ME-101	Basics of Mechanical Engineering	2	1	--	3	3
EE-101	Basics of Electrical Engineering	2	1	--	3	3
ME-151	Workshop Practice	--	--	4	4	2
ME-102	Engineering Mechanics Lab	--	--	2	2	1
Total		**16**	**6**	**12**	**34**	**28**

Semester II

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
AS-201	Human Resource Management	3	-	-	3	3
AS-202	Engineering Physics - II	2	1	--	3	3
AS-252	Physics Lab. - II	--	--	2	2	1
AS-203	Engineering Chemistry& Environmental Science	2	1	--	3	3
AS-253	Chemistry Lab. - II	--	--	2	2	1
AS-204	Engineering Maths. - II	3	1	--	4	4
AS-205	Innovative Technology& Biosciences	3	-	--	3	3
EC-201	Basics of Electronics and Comm.	2	1	--	3	3
CS-201	Fundamentals of Computing	2	1	--	3	3
ME-250	Engineering Graphics	--	--	4	4	2
Total		**17**	**5**	**8**	**30**	**26**

Semester III

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-301	Solid Mechanics	2	1	0	3	3
CE-302	Fluid Mechanics	2	1	0	3	3
CE-303	Civil Engineering Materials	3	0	0	3	3
CE-304	Surveying	3	0	0	3	3
CE-305	Engineering Geology	3	0	0	3	3
AS-301	Engineering Maths III	3	1	0	4	4
CE-351	Solid Mechanics Lab	0	0	2	2	1
CE-352	Fluid Mechanics Lab	0	0	2	2	1
CE-353	Civil Engineering Materials Lab	0	0	2	2	1
CE-354	Surveying Lab	0	0	2	2	1
CE-355	Engineering Geology Lab	0	0	2	2	1
Total		**17**	**3**	**10**	**30**	**24**

Semester IV

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-401	Structural Analysis I	2	1	0	3	3
CE-402	Hydraulics	2	1	0	3	3
CE-403	Building Construction	3	0	0	3	3
CE-404	Geomatics	2	1	0	3	3
CE-405	Estimating and Costing	3	0	0	3	3
CE-410	Numerical Analysis and Computer Programming	3	1	0	4	4
CE-451	Structural Analysis Lab	0	0	2	2	1
CE-452	Hydraulics Lab	0	0	2	2	1
CE-453	Civil Engineering Drawing	0	0	4	4	2
CE-454	Geomatics Lab	0	0	2	2	1
CE-460	Computer Lab	0	0	2	2	1
Total		**15**	**4**	**12**	**31**	**25**

Semester V

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-501	Structural Analysis II	2	1	0	3	3
CE-502	Design of Structure I	3	0	0	3	3
CE-503	Design of Structure II	3	0	0	3	3
CE-504	Open Channel Flow	2	1	0	3	3
CE-505	Soil Mechanics	3	1	0	4	4
CE-506	Environmental Engineering I	2	1	0	3	3
CE-552	Design of Structure I Lab	0	0	2	2	1
CE-553	Design of Structure II Lab	0	0	2	2	1
CE-555	Soil Mechanics Lab	0	0	2	2	1
CE-556	Environmental Engineering Lab I	0	0	2	2	1
CE-557	Survey Camp	0	0	2	2	1
Total		**15**	**4**	**10**	**29**	**24**

Semester VI

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-601	Structural Analysis III	2	1	0	3	3
CE-602	Design of Structure III	2	1	0	3	3
CE-603	Engineering Hydrology	2	1	0	3	3
CE-604	Geotechnical Engineering	2	1	0	3	3
CE-605	Environmental Engineering II	3	0	0	3	3
CE-606	Transportation Engineering I	3	0	0	3	3
CE-655	Environmental Engineering Lab II	0	0	2	2	1
CE-666	Transportation Engineering Lab	0	0	2	2	1
CE-667	Software Lab	0	0	2	2	1
Total		**14**	**4**	**6**	**24**	**21**

Semester VII

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-701	Design of Structure IV	2	1	0	3	3
CE-702	Irrigation Engineering	3	0	0	3	3
CE-703	Foundation Engineering	3	0	0	3	3
CE-704	Engineering Economics & Construction Management	3	1	0	4	4
CE-705	Environmental Engineering III	2	1	0	3	3
CE-706	Transportation Engineering II	2	1	0	3	3
CE-751	Advance Structural Design Lab	0	0	2	2	1
CE-754	Cons Management Lab	0	0	2	2	1
CE-757	Summer Practical Training	0	0	2	2	1
CE-760	Project	0	0	8	8	4
Total		**15**	**4**	**14**	**33**	**26**

Semester VIII

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
CE-801	Elective-I	3	1	0	4	4
CE-802	Elective-II	2	1	0	3	3
CE-803	Elective-III	2	1	0	3	3
CE-850	Seminar	0	0	2	2	1
CE-860	Project	0	0	16	16	8
Total		**7**	**3**	**18**	**28**	**19**
Grand Total		**116**	**33**	**90**	**239**	**193**

SEMESTER I

COMMUNICATION SKILLS
AS-101

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

1. Developing the concepts of communication skills/soft skills
2. Developing the syntactical concepts of grammar
3. Command over professional/technical writing skills
4. Developing a sense interpretation through literature and its social/political and ethical aspect
5. Proficiency in language handling/delivery through Englishphonetics and accent mechanism

SYLLABUS

Unit-I: The Art of Communication
English Communication, Technical, Verbal & Non-Verbal Communication, Barriers in Communication, The Art of Communication; Reading, Writing, Listening, Speaking and Strategies to overcome challenges in effective communication.

Unit-II: Fundamentals of English Syntax
Basics of Parts of Speech, Determiners, Use of tenses, Transformation of sentences, Active- Passive; Direct-Indirect; Simple-Compound-Complex sentences, Use ofPrepositions, Discourse Markers, Subject Verb Concord, Use of Conjunctions, Use ofVerbs.

Unit-III: Writing
Formal & informal letters, unmade communication and Demand Communication Note Making, Report writing, Book Reviews, Abstracts and Research Proposals, creative writing, Email correspondences, Résumé writing, Executive summery.

Unit-IV: Word Vocabulary & Phonetics
Word formation, foreign roots (Etymology) , Suffix, Prefix, Antonyms, Synonyms, Homonyms, one word substitution, Idioms and Phrases, Acronyms, IPA Symbols, Vowels and Consonants, Place and Manner of Articulations, Phonetic transcription and Accentuation (theoretical insight).

Unit-V: Literature
Poetry
Where the Mind is Without Fear-
Rabindranath Tagore
The Express- Stephan Spender
Amalkanti-NirendranathChkrabarti
Road Not taken- Robert Frost

Prose
Of Studies- Francis Bacon,
Vanishing Animals- Gerald Durrell
Fitin : Old man and the Sea – E Hemmingnoy
The Child- MunshiPremchand
Soapnut Leaves- Chaaso

Text Books:

1. The Joy of Reading: Orient Blackswan Pvt. Ltd, New Delhi
2. Fluency in English: Macmillan Publishers, New Delhi
3. Intermediate Grammar Usage and Composition :M.L.Tikoo and Subramanian , Orient Blackswan Pvt. Ltd, New Delhi
4. A Text Book of English Phonetics for Indian Students: T. Balasubramanian, Macmillan Publishers, New Delhi.
5. Practical English Usage: Michael Swan, Oxford University Press.

Suggested Reading:

1. The Oxford Guide to effective Writing and Speaking Skills: John Seely, Oxford University Press
2. English Pronouncing Dictionary: Daniel Jones, Cambridge University Press.
3. Technical communication Principles and Practice: Meenakshi Raman and Sangeeta Sharma, Oxford.

ENGINEERING PHYSICS – I
AS-102

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

1. Enhancing the concepts of conservative and non-conservative forces
2. Understanding the basics of optics and introduction to lasers including their applications in field
3. Expanding the concepts of electromagnetism and its various applications
4. Exploring the basics of quantum ideas: photoelectric effect, Compton effect, Planck's hypothesis etc.
5. Understanding the physics of solids.

SYLLABUS

UNIT-1: Physics of Motion

Inertial and non-inertial frames, conservation principles of momentum and energy; many particle systems, rocket motion, simple harmonic motion, damped harmonic motion.

UNIT-II: Optics

Two views about nature of light, concept of coherence, interference of light, single slit and N-slits diffraction, hydrogen atom spectrum, diffraction grating and spectral resolution.

UNIT-III: Electromagnetism

Cylindrical coordinates, Gradient, divergence and curl, line integral, surface integral and volume integral, Lorentz force, Gauss's law, Ampere's Law, Maxwell's equations, electromagnetic waves and Poynting vector.

UNIT-IV: Quantum Ideas

Difficulties of classical Physics, Planck hypothesis, wave particle duality, photoelectric effect, Compton effect, uncertainty principle and its implications, wave packets, group velocity and phase velocity, Davisson Germer experiment.

UNIT-V: Physics of Materials
Classifications of materials, crystal structure, unit cell and lattice parameters, Miller indices, Bragg's law and X-ray diffraction, classical free electron theory, its success and failures, Wiedemann Franz law, Maxwell Boltzmann distribution.

Text Books:

1. Physics by Halliday and Resnick
2. Modern Physics by Mani Mehta
3. Modern Physics by Beiser

Reference Books:

1. Relativity by Resnick
2. Optics by Ghatak

ENGINEERING CHEMISTRY-I
AS-103

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

1. Understanding the instrumental methods of analysis
2. Exploring the chemical methods and phase rule
3. Expanding the knowledge of electrochemistry and surfactants
4. Understanding the mechanism, classification, properties and applications of polymers
5. Understanding composites and nanomaterials

SYLLABUS

UNIT-1: Chemical And Instrumental Methods of Analysis
Gravimetric Analysis; Digestion and its Importance, Favorable Conditions for Precipitation, Volumetric Methods of Analysis; Expression of concentration of solutions Acid-Base (pH metry and conductometry), Redox, Precipitation and Complex metric Titrations. Chromatography; Definition and Different Types of Chromatography, Fundamentals of Spectroscopy; Principles and Applications of UV-Visible, Infra-Red and Atomic Absorption Spectrometry.

UNIT-II: Electrochemistry and Surfactants
Electrolytic and Galvanic cell, Electrode Potential, Standard Electrode Potential, EMF series, Nernst Equation, Cell emf Measurement, Reversible and Irreversible cell, Thermodynamic Overview of Electrochemical Processes, Conductance, Cell Constant and its Determination. Surface Active Agents, Soaps, Types and Advantages of Detergents, Critical Miceller Concentration, Hydrophilic and Hydrophobic Interactions, HLB values, Fricoohesity of Surfactant Solutions.

UNIT-II: Molecular Structure and Phase Rule
Valence Bond Theory, Molecular Orbital Theory, Molecular Orbital of Polyatomic Molecules, Molecular orbital Theory of Solids, crystal structure, Semiconductors and Superconductors. Phase Rule; Phase Rule Applications to One and Multiple Component systems, Fe-C Phase Equilibrium Diagram, Types of Alloys, Ferrous and Nonferrous Alloys.

UNIT-IV: Polymers
Basics of polymer chemistry, Molecular weight, Glass transition temperature and Melting point, Methods of polymerization, Structure property relationship, Thermoplastics and Thermosets, Fabrication of polymers-Compression, Injection, Extrusion and transfer Moulding. Synthesis,

Properties and uses of polyethylene, Polyvinyl Chloride, Poly Methyl Methacrylate, Urea formaldehyde resin and Melamine formaldehyde resin, Elastomers and Conducting polymers.

UNIT-V: Nanomaterials and Composites
General Introduction, Fullerenes, Carbon nanotubes, Nanowires, Electronic and Mechanical properties, Synthesis of nanomaterials, Top down and Bottom up approaches, Applications of nanomaterials. Adhesives and their classification, Composites; their Compositions, Characteristics and types.

Text Books:

1. Instrumental Methods of Analysis by Willard Meritt, Dean, Settle, CBS Publishers
2. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Company (P) Ltd.
3. Engineering Chemistry: A textbook of Chemistry for Engineers, Wiley, India

Reference Books:

1. Engineering Chemistry by Shashi Chawla, Dhanpat Rai Publishing Company (P) Ltd

ENGINEERING MATHEMATICS – I
AS-104

L: 3 T: 1 P: 0 Cr: 4

COURSE OUTCOMES

1. Tracing the curve and understanding its behaviour at the point of infinity(Asymptote).
2. Learning the concepts of successive differentiation and the expansion of functions in form of series.
3. Finding maxima and minima of a function of two and more variables and the concept of Eigen values.
4. A study of ordinary differential equations and its applications.
5. Learning the concepts of partial differential equations with applications.

SYLLABUS

UNIT-I: Curve Tracing & Applications Of Definite Integrals
Two Dimensional curve tracing in Cartesian, polar and parametric forms, Double points & points of inflexion, Oblique and parallel asymptotes, Finding length, volume and surface area of the curve in Cartesian, polar and parametric forms.

UNIT-II: Techniques of One Variable Calculus & Partial Differentiations
Leibnitz's theorem; n^{th} derivative of F(x) at x=0, Maclaurin's expansion of F(x), Formation of Intrinsic and pedal equations, Partial derivatives and their geometrical interpretation, Total derivative, Total differential coefficient, change of variables i.e. use of Jacobeans.
Curvature and radius of curvature in Cartesian, polar and parametric and implicit forms, Radius of curvature at the origin, centre and chord of curvature, and evolutes of the curves.

UNIT-III: Calculus Of Several Variables & Linear Algebra
Taylor's expansion of a function of one & two variables, Leibnitz's rule for differentiation under the

sign of integration, Maxima and minima of a function of two and more variables including Lagrange's method.
Consistency of a system of simultaneous linear equations using rank, Eigen values and Eigen vectors of a square matrix, Properties of Eigen values, Applications of Cayley-Hamilton theorem and diagonalizationof a matrix, vector space, basis, linear dependence and independence of vectors, Linear transformations and related problems

UNIT-IV: Ordinary Diffrential Equations
Orthogonal and lsogonal trajectories of a family of curves, Complementary function, particular integral and general solution of ordinary linear differential equations of higher order with constant and variable coefficients (Cauchy and Legendre forms).
Method of variation of parameters Method of undetermined coefficients and solutions of simultaneous differential equations with constant coefficients.

UNIT-V: Partial Differential Equations
Introduction to partial differential equations, Change of independent variables in P.D.E., Complete solution of homogeneous and non-homogeneous L.P.D.E. of higher order with constant and variable coefficients, Solutions of one dimensional wave equation, one dimensional heat conduction equations and two dimensional Laplace (Cartesian and polar forms) equation using method of separation of variables.

Text/ Reference Books:

1. A.B. Mathur& V.P. Jaggi : A text book of "Engg. Maths. & Advanced Engg. Mathematics"
2. V.P.Mishra: "Concept of Engineering Mathematics" (Revised Edition)
3. B.S. Grewal: "Engineering Mathematics & Higher Engineering Mathematics"
4. B.V. Ramana: "Higher Engineering Mathematics".
5. R.K. Jain and S.R.K. Iyengar : "Advanced Engineering Mathematics", 4th Edition
6. J.S.Bindra & K.S. Gill, S.K. "Applied Mathematics" Kataria& Sons, Ansari Road, Darya Ganj, Delhi-110002

BASICS OF CIVIL ENGINEERING
CE-101

L: 2T: 1 P: 0 Cr: 3

COURSE OUTCOMES
On completion of the course, the students will be able to:
1. determine the engineering properties of the materials and solids.
2. analyze the internal forces for statistically determinate and compound members.
3. apply the concept of compound stresses for axial, flexure, shear and torsion.
4. apply the concept of principal strain and strain tensor for the analysis of different structural members.
5. apply the concepts of shear force, bending moment, axial force for statically determinate beams.

SYLLABUS

Unit-I: Stresses & Strains:
Introduction, normal stress & strain, shear stress & strain, relationship between stress and strain, Uniaxial tension test: Stress-Strain diagrams for different materials, Mechanical properties of materials: isotropy, homogeneity, continuity, elasticity, brittleness, yielding, plasticity, work hardening, ductility, hardness, toughness, creep, relaxation, fatigue; Uniaxial deformations: Saint Venant's principle, principle of superposition, free body diagrams, bars of uniform cross sections.

Unit-II: Uniaxial Deformations:
Bars of variable cross sections, compound/ composite bars, temperature stresses.

Unit-III: Analysis of Stresses:
Tensor notations, equilibrium equations, transformation of stresses, invariants of stress tensor, plane stress condition, principal stresses, maximum shear stress and their planes, Mohr's circle.

Unit-IV: Analysis of Strains:
Transformation of strains, invariants of stain tensor, plane strain condition, principal strains, maximum shear strain and their planes; Strain Rosettes; Stress –Strain relationship, generalized Hooke's law, relation between elastic constants.

Unit-V: Structures and Their Forms:
Loads, idealization of structures, supports and connections, elastic and linear behaviour of structures, determinate and indeterminate structures, SF & BM: relation between B.M., S.F. and loads, S.F. & B.M. diagrams in statically determinate simply supported (without overhang) and cantilever beams subjected to concentrated loads and UDL

Text Books

1. Engineering Mechanics of Solids By E.P. Popov, Pearson Education.
2. Solid Mechanics by S.M.A. Kazimi, Tata McGRAW HILL.
3. Mechanic of Materials by R.C. Hibbeler, Pearsons Education

Reference Books

1. Mechanics of Materials by Beer &Jonhson, Dewolf, McGRAW HILL.
2. Strength of Materials by S. Timoshenko, CBS Publisher
3. Strength of Materials by R. K. Rajput, S Chand

BASICS OF MECHANICAL ENGINEERING
ME-101

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

1. Understanding various thermodynamic systems, properties and other related concepts
2. Expanding the knowledge of reversible and irreversible cycles
3. Learning the basics of first law and second law equations and related theories with numerical
4. Studying the kinematics of fluid flow
5. Understanding the dynamics of fluid flow

SYLLABUS

Unit-1:
Thermodynamics systems, Properties, Thermal equilibrium, Zeroth Law of thermodynamics and concept of temperature. Work, displacement work in various Quasi-state systems, First law of thermodynamics, application to cyclic process, Internal energy, Enthalpy. Pure substance, control volumes, Application of first law to non-cyclic process, Steady Flow energy equation.

Unit-II:

Reversible and Irreversible process, Second law of thermodynamics, Kelvin-Planck and Clausius statement and their equality. Entropy generation, Entropy balance equation for closed and open systems.

Unit-III:

First law and second laws equations, Maxwell's relation, Carnot cycle. Definition and properties of fluids, Classification of fluids, Normal and shear stresses in fluids.

UNIT-IV:

Kinematics of fluid flow; Types of flow, flow pattern, Velocity and rotation, acceleration of fluid particle, velocity potential function, Differential equation of conservation of mass.

Unit-V:

Dynamics of ideal fluids flow; Euler's equation of motion, Bernoulli's equation and its application, Flow measuring device, Venture-meter, orifice-meter and nozzle meter, pilot-static tube, hydraulic co-efficient, Flow through pipes, Major and Minor losses in pipe flow.

Text books:

1. Engineering Thermodynamics by: P. K. Nag, TMH.
2. Fundamental of classical thermodynamics by: Wan- Wylen&sontag, John wiley&sons.
3. Engineering thermodynamics by: Spalding & code.
4. Engineering Mechanics: Statics and Dynamics: by J. L. Meriam and L. G. Kraige, John Wiley &Sons, Inc.
5. Engineering Mechanics: Dynamics: 12th Edition by R. C. Hibbeler, Prentice Hall
6. Engineering Mechanics: by K.L. Kumar, Tata Mc Graw Hill.

BASICS OF ELECTRICAL ENGINEERING
EE-101

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES:

1. To analyse circuit systems using direct application of Kirchoff current and voltage laws along with Ohms law
2. To understand basic concept of "j" operator, RLC series circuit, reactive power, true power and apparent power
3. To prepare the students to have basic knowledge of transformers, the equivalent circuit model of single phase transformers, transformer parameters using open circuit and short circuit tests, compute transformer efficiency and voltage regulation
4. Construction and understanding of working principles of DC generators and motors
5. The ability to select a suitable measuring instrument for a given application like PMMC and MI

SYLLABUS

Unit-I:

Fundamentals of electric circuits, Kirchhoff's laws, mesh analysis, node analysis, delta-star and star-delta conversion, classification of network elements, Thevenin's theorem, Nortan's theorem maximum power transfer theorem, superposition theorem.

Unit-II:
Single phase AC circuits, average and effective values of sinusoids, solution of R,L,C series circuits, the j operator, complex representation of impedances, phasor diagram, concept of power factor, power factor improvement, power in complex notation, solution of parallel and series-parallel circuits, resonance. Introduction to balance three phase AC circuits.

Unit-III:
Ampere's circuital law, B-H curve, solution of magnetic circuits, hysteresis and eddy current losses. Relays as an application of magnetic force. Transformers- construction, e.m.f. equation, ratings, phasor diagram for no load and full load, equivalent circuit, regulation and efficiency calculations, open circuit and short circuit tests, Introduction to Auto-Transformer.

Unit-IV:
Introduction to Electromechanical Energy Conversion, DC motors- construction, e.m.f. and torque equations, characteristics of DC generators and motors, speed control of DC motors. DC motor starter- working principle, ratings. Introduction to three phase induction motor, Introduction to alternator and synchronous motor and their applications.

Unit-V:
PMMC instruments, shunts and multipliers, multi-meters, moving iron ammeters and voltmeters, dynamometer wattmeter, AC watt-hour meters, extension of instrument ranges.

Text Book:

1. D.C. Kulshrestha, "Basic Electrical Engineering", Tata McGraw Hill.
2. T.K. Nagsarkar&M.S.Sukhija, "Basic Electrical Engineering", Edition 2008, Oxford University Press.

Reference books:

1. V. Del Torro, Electrical Engineering Fundamentals, Second Edition, Prentice Hall of India Pvt. Ltd.
2. E. Hughes, Electrical Technology, English Language Book Society Publication with Longman.
3. H. Cotton, Advanced Electrical Technology, Issae Pitman, London.
4. S.S. Parker, Problems in Electrical Engineering, Asia Publications.
5. I. J. Nagarath, "Basic Electrical Engineering", 2nd Edition, Tata McGraw Hill.

WORKSHOP PRACTICE
ME-151

L: 0 T: 0 P: 4 Cr: 2

COURSE OUTCOMES:
1. To instil fundamentals of materials, properties, various tools and their specifications employed in various shops/trades
2. To understand science and engineering of every task and tool employed in each shop/trade
3. To understand the drawing and specification of various tasks/jobs; plan, operate and acquire tools to make jobs as per specifications
4. Encourage student to use web/computing resources and relate the completed task with real life processes
5. Educate them for safety and security while performing assigned tasks in group of small size, prepare the record of tasks and submit

SYLLABUS

Unit-I: Foundry

Mould cores, core prints, gates runner, risers, chaplets, common defects in casting, defects due to mould, metal pouring, solidification.

Unit-II: Metal Joining
Oxy acetylene gas welding equipment, types of flame, electric arc and contact welding, electrodes and equipments for AC and DC welding, electrode coating functions and constitutes, common welding defects.

Unit-III: Metal Cutting Operation And Tools
Common metal cutting machine like lathe, milling, shaper, slotter and drill, lathe operations like turning, chamfering, facing, taper turning and knurling, material for lathe tools and other tools, bench grinder and use.

Related Labs:
1. Gas welding: simple joint like joint.
2. Electric Arc Welding: Simple joints like butt joint.
3. Tin Smithy: Mechanical joining, jobs like box, tray, funnel and soldering of joints.
4. Turning: Plane turning, taper turning, threading, knurling, facing and chamfering on the same job.
5. Shaping: Surface finishing at right angles.
6. Milling: Making a slot two or three surface finishing at angles of 1200C.
7. Drilling: Making drilled holes in plates or flats and grinding the corner of a plate to round.

Text books/ Reference books:
1. Elements of Workshop Technology by, Choudhary Vol. 1 & 2. Media promoters and publisher, 1996.
2. Workshop Technology, Vol. 1-3 by W A J Chapman, ELB. S

SEMESTER II

HUMAN RESOURCE MANAGEMENT
AS-201

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

1. Forming a foundation of human resource management
2. Understanding the procedure of acquisition of human resources
3. Making clear the importance of appraisals and evaluation in human resource
4. Learning importance of training and development of human resource
5. Analysing the management of job stress and employee health and well being

SYLLABUS

Unit-I: Foundation of Human Resource Management (HRM):
Meaning, definition, nature and scope, characteristic, objectives, Opportunities and challenges in HRM, HRM functions.

Unit-II: Acquisition of Human Resources
Human Resource Planning (HRP): need, objectives, determinates, HRP models, HRP process, type of HRP, benefits; Job Analysis (JA): sources, methods, process, uses, importance; job description, job specification; Recruitment and selection: sources, process, barriers, objectives, objectives of selection, selection tests, interview, induction, placement and employee socialization.

Unit-III: Appraising and evaluating Human Resources
Performance Appraisal (PA)and feedback: approaches, methods/techniques of PA, process of PA, interview, elements, designing and conducting PA; Job Evaluation (JE): principles, process, methods of JE, importance and limitations.

Unit-IV: Development of Human Resources
Human Resource Development (HRD): functions, benefits, importance, barriers to HRD; Training and Development: models, methods, training process, training evaluation and barriers.

Unit-V: Employees Health &Well being –Job stress and Job Burnout: Nature, Causes and consequences
Stress: Nature, Causes and consequences; Management of Stress: Personal and organizational based strategies; Burnout: Nature, symptoms, causes, relationship with stress, burnout and job satisfaction management of burnout.

Text Books:

1. Gary Dessler (2015), Human Resource Management, Person Prentice Hall of India, New Delhi
2. VSP Rao, Human Resource Management, Text & Cases (2nd edition), Excel Books, New Delhi

Reference Books:

1. Tapomony Deb, (2009), Managing Human Resource and Industrial Relations (First edition), Excel Books, New Delhi
2. John M. Ivancevich (2005), Human Resource Management 93rd edition) Tata McGraw Hill Publishing Co. Ltd., New Delhi

ENGINEERING PHYSICS – II
AS-202

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

1. Learn to apply relativity in describing physics of motion
2. Appreciate the importance of lasers and grasp the physical bases
3. Learn the calculation methods of quantum theory
4. Apply quantum ideas to explain behaviour of materials
5. Appreciate physics conservation laws and be acquainted with new areas

SYLLABUS

Unit-I: Relativity

Difficulties of classical theory, idea of ether, Michelson Morley Experiment, Galilean transformations, postulates of special theory of relativity, Lorentz transformations, Einstein velocity addition theorem, time dilation, length contraction, relativistic mass, momentum and energy, natural units, principle of equivalence.

Unit-II: Lasers

Principle of laser action, Einstein's transition probabilities, lifetime of transitions, rate equation for atomic transition, optical resonators, ruby laser, He-Ne laser, general characteristics of lasers, applications of lasers.

Unit-III: Quantum Theory

Schrodinger equation, time dependent and independent forms, wave function, probabilistic interpretation, one-dimensional problems, particle in a box, elementary treatment of harmonic oscillator, potential barrier and possibility of tunnelling.

Unit-IV: Physics of Materials

Bose Einstein statistics, Fermi Dirac statistics, semiconductors, intrinsic and extrinsic, carrier concentration, origin of energy gap, Kronig Penney model, Basics of semiconductor devices and applications, Electrical & optical properties.

Unit-V: Frontiers of Physics

Basic interactions, symmetry, invariance and conservation laws, elementary particles and their classification, accelerator physics and applications, last Nobel prize in Physics, its back ground, significance and possibilities of future developments.

Text Books:

1. Physics by Halliday Resnick
2. Modern Physics by Mani Mehta
3. Modern Physics by Beiser

Reference Books:

1. Relativity by Halliday Resnick
2. Optics by Ghatak:

ENGINEERING CHEMISTRY& ENVIRONMENTAL SCIENCE
AS-203

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

1. Understanding importance of use of water in industries, softening methods and problems on water treatment
2. Understanding basis of fuels analysis and their combustion
3. Exploring the corrosion and protection
4. Understanding environment and pollution
5. Understanding environmental biochemistry

SYLLABUS

Unit-I: Water Treatment

Water Quality Parameters (BIS & WHO Standards), types of hardness, Units, Determination of hardness by EDTA method, Alkalinity of water & its significance, Numerical problems, Problems with boiler feed water and its treatment; Scale & Sludge formation, Boiler corrosion, Caustic Embrittlement, Priming & foaming, Softening methods; Lime-soda, Zeolite & Ion Exchange processes, Numerical problems, Chlorination of water, Coagulation, Sedimentation and Desalination.

Unit-II: Energy Resources

Types of fuels, Calorific values, (HCV & LCV) and determinations by Bomb and Boys gas calorimeter, Numerical problems, Coal; Types of coal, Analysis of coal, Liquid Fuel; Refining of petroleum, Knocking, Octane and Certance Values, Pollution from fossil fuels, Combustion and Problems. Renewable; (Solar Cells, Rechargeable Batteries, Fuel Cells) and Non-renewable of energy; (Wind Energy, Geothermal Energy, Ocean Energy) resources of Energy.

Unit-III: Corrosion And Its Protection

Corrosion; Definition and its scope, Chemical Corrosion, Electrochemical Corrosion, Mechanism of Chemical and Electrochemical Corrosion, Types of Corrosion; Intergranular Corrosion, Soil Corrosion, Waterline Corrosion, Differential Aeration Corrosion, Galvanic and Concentration Cell Corrosion, Factors affecting corrosion, Protection of corrosion.

Unit-IV: Environmental Chemistry

Environment and its Segments, Zones of Atmosphere, Air Pollution: Air pollutants and their resources; Aerosol and its Types, RSPM, SPM, Acid rain, Green House Effect, Global warming, Ozone Layer Depletion, Water Pollution; Sources of water pollution, Sewage Treatment, Determination and Significance of COD, BOD, TOC. Noise Pollution, Soil Pollution, Radioactive Pollution and e-Waste.

Unit-V: Environmental Biotechnology

Biotechnology and its applications, fermentation, production of alcohol and vitamins, Biotechnology for environmental Protection, Biological indicators, biosensors, bioremediation, Phytoremediation, bio-pesticides, bio-fertilizers, bioreactors, Social issues, biodiversity and its conservation.

Text Books:

1. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Company (P) Ltd.
2. Engineering Chemistry: A textbook of Chemistry for Engineers, Wiley, India

Reference Books:

1. Adsorptuion: Remediation of Heavy Metals and Organic Pollutants by Firoj Ali Ansari and

Masood Alam, Lambert Academic Publishing

2. Removal of Heavy Metals and Ground Water Pollution in Delhi, India

ENGINEERING MATHEMATICS – II
AS-204

L: 3 T: 1 P: 0 Cr: 4

COURSE OUTCOMES

1. Tracing of 3D curves and evaluation of multiple integrals by change of variables/change of order of integration.
2. Learning the concepts of non-linear ordinary and partial differential equations.
3. Study of analytical functions, residues and conformal mapping.
4. Solutions of system of differential equations, integral equation, Integro-differential equations, difference equations using Laplace transformation.
5. Learning of theory of Fuzzy Mathematics with its applications.

SYLLABUS

Unit-I: Solid Geometry & Multiple Integrals

Formation of equations of cylinder and cone under the given geometrical conditions, Tracing of some quadric (or Conicoids) three dimensional surfaces.

Evaluation of multiple integrals by change of order of integration, Change of variables i.e. Use of Jacobian & Applications of multiple integrals in finding plane area, mass, centre of gravity, centre of pressure, moment of inertia, product of inertia, curved surface area and volume.

Unit-II: Ordinary & Partial Differential Equations

Ordinary point and regular singular point, Series solutions of ordinary differential equations of second order with variable coefficients (polynomials) by the method of Frobenius; Lagrange's method of undetermined multipliers for the solution of linear partial differential equations of first order solution of non-linear partial differential equations of first order by means of transformations and Charpits methods.

Unit-III: Complex Analysis

Analytical function, C-R equations in Cartesian and polar forms, Geometrical representation of $\omega=F(z)$, Determination of conjugate harmonic function, Milne – Thomson meyhod and related problems; Evaluation of complex integrals using Cauchy's integral theorem, Cauchy's integral formula for the n^{th} order derivative of an analytic function.

Taylor series, Maclaurin series and Laurent series expansions of functions, Conformal mapping, sufficient condition for conformality of $W=f(z)$, some standard transformations; zeros, singularities and residues of an analytic function, Application of Cauchy's residue theorem in solving contour integrals and evaluation of real definite integrals using residue method.

Unit-IV: Laplace Transform & Its Applications

Laplace and inverse Laplace transforms of some well-known elementary functions and Special functions, Change of scale property, First and second shifting theorems, Laplace transforms of Derivative, Integral, $t^nf(t)$, $f(t)/t$, Convolution theorem & Periodic function.

Applications of Laplace and inverse Laplace transform in finding the particular solutions of ordinary linear differential equations with constants and variables coefficients, system of differential equations, integral equation, Integro-differential equations, difference equations and, conversion of differential equations into integral equations & vice versa.

Unit-V: Fuzzy Mathematics

Fuzzy set, elements of Fuzzy logic, Relations including operations, reflexivity, symmetry and

transivity, Pattern classification based on fuzzy relations, fuzzy analysis including metric spaces, distance between fuzzy sets, area perimeter, height, width of fuzzy subsets, continuity & integrals.

Text/ Reference Books

1. A.B. Mathur& V.P. Jaggi: "**Engineering. Mathematics & Advanced Engineering Mathematics" (two volume)**
2. V.P.Mishra: "**Concept of Engineering Mathematics"** (Revised Edition)
3. B.S. Grewal: "**Engineering Mathematics & Higher Engineering Mathematics**",43rd Edition
4. B.V. Ramana: "**Higher Engineering Mathematics"**.
5. R.K. Jain and S.R.K. Iyengar : "**Advanced Engineering Mathematics"** 4th Edition

INNOVATIVE TECHNOLOGY& BIOSCIENCES
AS – 205

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

1. Understanding the concept of nanotechnology
2. Learning the applications of nanotechnology in multiple disciplines
3. Understanding the concepts of biological sciences,genetics, biological indicators and biosensors
4. Exploring the field of advanced biological sciences and biotechnology
5. Exploring nano-biotechnology and its various applications

SYLLABUS

Unit-I: Introduction to Nanotechnology

Introduction to Nanotechnology, Theoretical Basis of nanotechnology, Quantum confinement and size effect, Classification of Nanomaterials: Nanowires, Quantum Welland Quantum Dots, Properties of Nanomaterials, Carbonaceous Nanomaterials and their examples. Molecular Nanotechnology, GreenNanotechnology.

Unit-II: Applications of Nanotechnology

MicroelectromechanicalSystems(MEMS)&NanoeletromechanicalSystems(NEMS),Nanorobotics,Nanofluidics,Micro-gearsandNano-gears,NanocompositesandtheirapplicationsNanomaterialsforCivilEngineers, Nano-paints, Light and flexible Civil Engg. Structures based oncarbonNanomaterials, Nano-memories. Nano-sensors. Nano-transistors, Introduction to organic electronics.

Unit-III: Introduction to Biological Sciences

Introduction to the cellasa unit of life, Principles involved in the maintenance of life processes, Ultra-structure and function of cellular components-Prokaryotic and Eukaryotic cells, cell wall, plasma membrane, endoplasmic reticulum, Biomolecules-Carbohydrates. Lipids, Amino Acids, proteins, Nucleic Acids, Tissue Systems. Metabolism, Chromosomes and CellDivision.BasicGenetics-biologicalindicators,bio-sensors,Mutation-causes.typesandeffect.

Unit-IV: Advanced Biological Sciences

Introduction to microbiology, Industrial microbiology, introduction to immunology, Introduction to molecular genetics, Structure of RNA aid DNA, Concept of Gene, Gene regulation, Basic concepts of biotechnology: Tot potency and cell manipulation, Classifications of biotechnologies.

Unit-V: Nanobiotechnology
Introduction to Nanobiotechnology, Nanobiotechnology in medicine: regenerative medicine, Targeted drug delivery. Nanotechnology in pharmacy, Nanobiotechnology in Ayurveda, Alternative medicines. Nan biotechnology in Agricultural, industrial Nan biotechnology, Nan imaging, Cancer treatment using Nanotechnology.

Text Books:
1. Nano the Essential by T. Pradeep
2. The Cell by Bruce Alberts

Reference Books:
1. Molecular Biology by Karp

BASICS OF ELECTRONICS &COMMUNICATION ENGINEERING
EC-201

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES
1. Studying semiconductor diodes and their various characteristics
2. Expanding the ideas: construction and working of BJTs and introducing JFET
3. Exploring various types of operational amplifiers
4. Understanding the idea of feedback and thus studying various electronic instruments
5. Learning various parameters of communication systems

SYLLABUS

Unit-I: Semiconductor Diodes:
P-N junction diode, V-I characteristics, static and resistance, linear and non-linear applications of diodes; half wave, full wave and bridge rectifiers, zener diode, characteristics and its use as a voltage regulator, AND, OR, NAND, NOR and Ex-OR gates.

Unit-II: Transistors (Bjt & Jfet):
Bipolar junction transistor (BJT) , biasing and amplifier action, load line analysis of transistor amplifier, BJT amplifier configurations and their comparison using small signal h-parameter model, Junction field Effect transistor (FET), biasing and amplifier action.

Unit-III: Operational Amplifier:
Op-am- basics, practical op-ampcircuits, inverting and non-inverting amplifier, summing amplifier, integrators and differentiators.

Unit-IV: Feedback And Electronic Instruments:
Feedback concept, Barkhausen Criteria of oscillation, Wein Bridge and phase shit oscillator, cathode Ray oscilloscope (CRO), electronics multimeters.

Unit-V: Communication Systems:
Introduction to modulation, amplitude modulation generation of AM waves, demodulation of AM wave, introduction to FM.

Text Books:

1. Boylestad & Nashelsky, Electronic Devices and Circuit Theory, 9th Ed, Pearsons
2. Dinesh Prasad, Basic of Analog Electronics, Scitech Publications

Reference Books:

1. Sedra and Smith, Micro Electronic Circuits, 6th Ed, Oxford Press

FUNDAMENTAL OF COMPUTING
CS- 201

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

1. Students will able to understand the basics of computer, generation & types of computer, its components and number system
2. Students will able to understand the concept of algorithms, flowchart and c programming language
3. Students will able to develop c programs for string manipulation, sorting and searching techniques
4. Students will able to describe the functions, structure and different types of operating systems
5. Students will able to understand basics of networking, internet and database management systems

SYLLABUS

UNIT-1: BASICS OF COMPUTERS

Computer fundamentals, Bits and Bytes, CPU, Memory, Types of memory, Input and output devices, I/O devices, Operating system, applications software's, system software. Number system, decimal number system, Binary number system, octal number system, hexadecimal number system. Generation of computer, Classification of computer,

UNIT-II: C PROGRAMMING

Algorithms, flow chart, The C character set, constants, variable, keywords, operator and expressions, decision controls, if and else, conditional operator, for loop, while loop and do-while loop,, switch case, user defined functions, call by value and by reference, array, and single dimensional, 2D matrix, multidimensional arrays

UNIT-III: SEARCHING AND SORTING

Strings, library string functions, pointers and structures, searching and sorting, linear search, binary search, sorting techniques: bubble sort, selection sort

UNIT-IV: OPERATING SYSTEM

OS definition, role of OS in computer system, multi programming, time sharing OS, multitasking OS, multiprocessing OS, real time system OS , client server computing, distributed OS, function of OS (user interface, GUI, program execution, I/O management, Resource management,

UNIT-V: NETWORKING & DBMS

Network, communication models, transmission media, connection topologies, LAN, WAN, MAN, ISO-OSI model of networking, Internet, ISP, WWW, Email, URL, Web browsers, websites, intranet, DBMS, DBMS applications, Advantage of DBMS, Data abstraction.

Books:

1. "Computer Fundamentals & Programming in C", ReemaThareja, Oxford University Press
2. Ashok Kamthane, "Programming with C ".
3. M N Doja, "Introduction to Computers and Information Technology"
4. C Programming by YaswantKanetkar

ENGINEERING GRAPHICS
ME-250

L: 0 T: 0 P: 4 Cr: 2

COURSE OUTCOMES

1. Student will able to understand basics of drawing and design of engineering components
2. Student will able to understand scaling of designs
3. Student will able to understand the different view of any object
4. Student will able to understand detail construction of any object
5. Student will able to understand sheet metal work

SYLLABUS

Unit-I: Orthographic Projection

Conversion of pictorial/ isometric views into orthographic views of machine block. Identification of surface in orthographic views. Some practice on auto-Cad package.

Unit-II: Isometric Projection

Isometric scale, isometric projection of solids, missing line and missing views. Isometric view of simple objects when their orthographic views are given. Preparation of isometric views using Auto-Cad package.

Unit-III: Sectioning

Conventional representation in section of engineering materials. Methods of sectioning, sectional views of machine components, brackets, bushed bearing and foot step bearing. Unit IV FASTENERS: Sketches of different types of threads, permanent fasteners (riveted and welded joints), temporary fasteners (nut and bolt assembly, studs, keys. etc.)

Unit-V: Building Drawings

Symbols of electrical and sanitary items. Terminology used in building drawing, plan and elevation of 2/3- rooms building using Auto-CAD package, from corrosion, refractories, their manufacturer and properties: neutral, acid and basic refractors; glass its types and manufacture.

Text Books

A.N. Siddiqui, Z.A. Khan and Mukhtar, Engineering Graphics with Primer on Autocad

Reference Books

N.D. Bhutt, Engineering Drawing

SEMESTER - III

SOLIDS MECHANICS
CE-301

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. analyse behaviour of structural elements subjected to different types of stresses
2. analyse different types of beams subjected to bending action
3. apply theory of pure bending to determine stresses in different types of structural elements
4. determine slopes and deflection in beams using Macualay's and direct integration methods
5. analyse compression members under axial and flexural loading

SYLLABUS

Unit-I: **Thin Cylindrical shells**

Longitudinal and hoop stresses, volumetric strains; Thick Cylinders: Lame's equations, stresses due to internal and external pressure; Torsion: Circular and noncircular shafts, power transmitted by shafts; Concept of strain energy and resilience; Theories of failure.

Unit-II: Shear force and Bending moment

SF and BM Diagrams for simply supported over-hanged and cantilever beams subjected to moments and varying loads; SF, BM & Torque Diagrams for inclined beams & brackets subjected to concentrated load, udl, moments and varying loads.

Unit-III: Bending in beams

Bending theory, bending equation, bending stresses in rolled steel and built up sections; Shear stresses in beams: shear flow, shear centre, variation of shear stresses in beam cross-section.

Unit-IV: Deflection of beams

Direct integration and Macaulay's methods for simply supported and cantilever beams subjected to concentrated loads, uniformly distributed loads, varying loads and moments.

Unit-V: Columns and struts

Columns and struts subjected to compression and bending, middle third & middle fourth rules, core or kernel of sections, masonry column, dams and retaining walls; Long columns: Euler's, Rankine's and Secant formulae.

Text Books

1. Engineering mechanics of solids, E. P. Popov, Pearson Education.
2. Solids Mechanics, S. M. A. Kazimi, Tata McGRAW HILL.
3. Mechanics of Materials, R. C. Hibbeler, Pearsons.

References:

1. Mechanics of Materials, Beer &Jonhston, Dewolf, McGRAW HILL.
2. Strength of Material, S. Timoshenko.
3. Strength of Materials, R. K. Rajput.

FLUID MECHANICS
CE-302

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. develop relationships between different fluid properties and apply them to practical problems
2. analyze the stability of floating and submerged bodies using the principle of floatation.
3. apply the concepts of kinematics to solution of fluid flow problems.
4. apply the concepts of rotational mechanics for the analysis of source, sink, doublet, and flow past stationary and rotating cylinders.
5. apply Bernoulli's energy equation to solve real world problems.

SYLLABUS

Unit-I:

Introduction: Real and ideal fluids, concept of continuum approximation, properties of fluids, equation of state, coefficient of compressibility, bulk modulus of elasticity, Newtonian and non-Newtonian fluid, surface tension, capillarity, concept of viscosity, effect of temperature on viscosity.

Unit-II:

Fluid Static: Pascal's law, devices based on Pascal's law, hydrostatic law, pressure variation in isothermal and adiabatic condition; Manometers: Simple and differential manometers, relative equilibrium; Forces on submerged plane, inclined and curved surfaces; Buoyancy; Stability of floating and submerged bodies, meta center and meta centric height.

Unit-III:

Fluid Kinematics: Kinematics of fluid Motion, Eulerian and Lagrangian description, type of motion, concept of control volume and control surface, streamline, path line, streak line and stream tube, continuity equation in Cartesian coordinate and polar coordinate, one and two dimensional flows, acceleration of fluid element, linear momentum equation and its application- forces on pipe bends.

Unit-IV:

Fluid Rotation: Circulation and Vorticity , angular velocity in terms of velocity field, irrotational flow, velocity potential and stream function, flow net and its uses, free and forced vortex motion.

Unit-V:

Fluid dynamics: Naivier- Stoke's equation, Euler's equation of motion and integration along streamline; Bernoulli's equation, physical significance of different heads, Bernoulli's equation for isothermal and adiabatic flow; Application of Bernoulli's equation: pitot tube, , venturi meter, orifice meter, Concept of kinetic energy, and momentum correction factors; Flow through an orifice; Time required for emptying of tank.

Textbook

1. Frank. M. White, Fluid Mechanics, McGraw-Hill, 7th edition, 2011.

References book

1. John F. Doughlas, Janusz M. Gasiorek, John A. Swaffield, and Lynne B. Jack. Fluid Mechanics, Pearson, 2012
2. Bruce R. Munson, Donald F. Young, and Theodore H. Okiishi, Fundamentals of Fluid Mechanics, 5th Edition, John Wiley and Sons, 2006
3. Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, Introduction to Fluid

Mechanics, Wiley, 6th ed., 2003
4. A.K. Jain Fluid Mechanics, Standard Publishing House, Delhi,

CIVIL ENGINEERING MATERIALS
CE-303

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. understand the properties of different types of cement.
2. design concrete mixes and conduct tests on cement and aggregates.
3. use different types of special concretes in construction of structures.
4. understand and use properties of bricks, stones and wood in building construction.
5. understand and use properties of flyash, paints, varnishes, gypsum and water proofing materials in building constructions.

SYLLABUS

UNIT-1: Cement

Compounds and prepositions, types of Portland cement, pozzolaniccement , high alumina cement and other types, hydration mechanism and hydration products, setting and hardening, curing, strength of hardened cement, grade of cement, tests on cements, relevant BIS codes.

UNIT-II: Aggregates

Properties of coarse & fine aggregates, tests on aggregates, relevant BIS codal provisions, concrete: Ingredients of concrete, properties of fresh and hardened concrete, strength of concrete, W/C ratio of porosity, additives and their types, concrete mix design.

UNIT-III: Special Concretes

Reinforced cement concrete, polymer concrete, fibre reinforced concrete, ferrocement, light weight concrete, roller compacted concrete, ready mix concrete, self compacting concrete, high performance concrete, bacterial concrete.

UNIT-IV: Bricks & Stones

Forms of bricks, properties of bricks and stones, tests on bricks and stones, relevant BIS codes, timber: structure of wood, defects in timber, seasoning, preservation, plywood and its manufacturing.

UNIT-V: Other materials

Fly ash paints & varnishes, gypsum, tar, bitumen & asphalt, nano materials, smart materials, composite materials, geosynthetics, heat & sound insulating materials, water proofing materials.

Textbook

1. Building Materials by S.K. Duggal
2. Engineering Materials by S.C. Rangwala
3. Concrete Technology by M L Gambhir
4. Properties of concrete by A M Neville

Reference Books

1. Engineering Materials by R K Rajput

2. Civil Engineering Materials by Neil Jackson
3. Design of concrete mixes by Krishna Raju N, CBS publishers
4. Concrete Technology by Neville A.M and Brooks. J.J. PEARSON education.
5. Concrete properties and manufacturing by Akroyd T.N.W, Pergamon press

SURVEYING
CE-304

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

At the end of course work, a student will be able to:

1. apply different techniques of measurement of distances and elevations to solve real world problem.
2. establish horizontal control for detailed mapping and civil engineering structures.
3. produce contour and topographical maps of an area for civil engineering projects.
4. compute quantity of earthwork and establish stakes on the ground for setting out of structures.
5. set out circular and vertical curves on the ground.

SYLLABUS

Unit-I:

Concept of plane and geodetic surveying, classification of surveying, basic principles, measurement of horizontal distance by conventional methods, sources of errors; Concept and principle of leveling, instruments for leveling, types of spirit leveling, methods of booking and reduction of levels, errors in leveling.

Unit-II:

Concept of traversing, types of meridians and bearings; measurement of horizontal and vertical angles, traverse measurement and computation, omitted measurements.

Unit-III:

Fundamentals of plane table surveying, instruments employed, working operation, methods, errors; introduction and importance of tacheometry, stadia and tangential methods; importance of topographical survey, concept and characteristics of contours, methods and uses of contours.

Unit-IV:

Computation of area by different methods, estimation of volume of earthwork; Setting out of building and tunnel; Reconnaissance, preliminary and detailed survey for canals, highways, railways, sewer lines.

Unit-V:

Elements and geometry of horizontal curve, setting out of simple curve by linear and angular methods, compound, reverse and transition curves; Basics of vertical curves, setting out of vertical curve.

Text Books

1. Elementary Surveying, Charles D. Ghilani, Paul R. Wolf. 14th Edition, Prentice Hall, 2014.
2. Surveying and Leveling, T. P. Kanetkar and S.V.Kulkarni Vol.1 & 2, VidhyarthiGriha, Prakashan,Pune

Reference Books

1. Plane and Geodetic Surveying for Engineers, David Clark and Jackson J. E., CBS Publications and distributors, New Delhi.Advanced Surveying, Agor, Khanna Publications,Delhi.
2. Surveying-Bannister, Raymond and Baker, Pearson Education

ENGINEERING GEOLOGY
CE-305

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. get the knowledge of earth and its mineral matter
2. get the knowledge of rock and its physical and engineering properties
3. get the knowledge of tectonic activity with details of earthquake
4. get the knowledge of natural land use and soil
5. get the knowledge of site investigation for various types of Civil Engineering projects\

SYLLABUS

Unit-1:

Study of the internal structures such as crust, mantle and core of the earth. Mineral matter and physical properties of the rock forming minerals like metallic and nonmetallic minerals. Significance of minerals in Civil Engineering practices.

Unit-II:

Study of rocks, mode of formation and Classification of Igneous rocks. Physical and Engineering properties of igneous rocks. Relevance of Igneous rocks in civil engineering practices. Mode of formation and classification of Sedimentary Rocks. Physical and Engineering properties of Sedimentary rocks. Relevance of sedimentary rocks in Civil Engineering practices. Mode of formation and classification of metamorphic rocks. Physical and Engineering properties of metamorphic rocks. Relevance of metamorphic rocks in civil engineering practices.

Unit-III:

Study of Tectonic activity of the earth. Explanation of Fold, Fault, Joint and unconformities. Types of Fold, Fault, Joint and unconformities. Relevance of Fold, Fault, Joint and unconformities in Civil Engineering practices.

Unit-IV:

Weathering and erosion. Natural agencies of Weathering and Erosion. Types of Weathering. Formations of various types of landforms. Glacial land forms, wind landforms and fluvial landforms. Significance of various landforms in Civil Engineering practices. Formations of various types of soils.

Unit-V:

Site investigation Techniques. Geological Investigation for Dam site and reservoir, bridges, tunnels and building. Landslide and land subsidence. Study of earthquake, classification of earthquake, earthquake zoning in India. Rocks as engineering material. Hydrologic cycle and study of ground water.

Textbooks

1. A Text Book of Geology by P. K. Mukharji
2. Geology for Engineers ByDr. D.S. Arora
3. Engineering Geology Prabin Singh

4. Geology for Engineers by Krenin& Judd

References

1. Geology and Engineering, by Legeet, McGrawHill Book Company, 1998.
2. Geology for Engineers, by Blyth, ELBS, 1995

ENGINEERING MATHS III
AS-301

L: 3 T: 1 P: 0 Cr: 4

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. use integrals to solve physical problems based on Green's Theorem, Gauss Divergence Theorem, and Stoke's Theorem.
2. learn problems based on conditional probability, Law of total probability and Baye's Theorem using different distributions.
3. learn the applications of Fourier series andFourier transforms in solving numberless problems related to Civil Engineering.
4. learn linear programming and optimization to solve industry problems.
5. find out feasible solution of engineering problems for convergence and divergence.

SYLLABUS

Unit-I: Vector Calculus & Higher Calculus

Review of gradient, Curl, Divergence and directional derivatives: Line, Surface and volume integrals, Green's theorem in xy- plane, Gauss divergence theorem and Stoke's curl theorem (without proof), and related problems.

Extremals of functions (by mean of Euler- Poisson equation), Isoperimetric problems, Beta and Gamma functions, Dirichlet & Liouville's multiple integrals , Representation of a definite integrals in Legendre & Jacobi forms of Elliptic Integrals of first, second and third kind.

Unit-II: Probability & Statistics

Review of Theorems on Probability, conditional probability; Law of total probability, Baye's Theorem and related problems; Random variable and Probability distribution, mean & variance of Binomial & Poisson distributions, Normal, Gamma and ,Beta distribution and related problems, Moments, Moments generating functions, measures of Skewness & Kurtosis, Correlation and Regression Analysis.

Unit-III: Fourier Series & Fourier Transforms

Fourier's series (full range and half range) for arbitrary period, Representation of a function in terms of Fourier integral, Fourier Sine integral and Fourier Cosine integral, Infinite complex Fourier transform, Finite & infinite Fourier sine & cosine transforms and their inverse transforms, Properties of different transforms and associated theorems, application in integral equations and boundary value problems.

Unit-IV: Difference Equation & Linear Progrraming

Complementary function, particular integral and general solutions of linear difference equations with constant and variable coefficients, Formulation of LP problems, solution of LPP using graphical method and simplex method. Construction of dual of LPP, Optimization of LPP by dual simplex method and solution of transportation problems.

Unit-V: Convergence And Divergence Of Infinite Series & Special Functions

Generating functions, Recurrence relations and orthogonal properties for Bessel's functions $J_n(x)$ and Legendre's polynomials $P_n(x)$, Jacobi series, Fourier-Bessel series and Fourier-Legendre series, Differential equations reducible to Bessel form, Rodrigue formula for $P_n(x)$ and related problems. Test for convergence and divergence of infinite series using comparison test, D'Alembart's ratio test, Logarithmic test, Raabe's test, Cauchy n^{th} root test, Leibnitz test for convergence of alternating series, Absolute & conditional convergence and uniform convergence.

Text/ Reference Books:

1. A.B. Mathur& V.P. Jaggi : Advanced Engineering Mathematics
2. B.S. Grewal: Higher Engineering Mathematics, 43^{rd} Edition
3. R.K. Jain and S.R.K. Iyengar : Advanced Engineering Mathematics, 4^{th} Edition
4. H.C. Taneja : Engineering Mathematics Volume I, II.
5. Erwin Kreyszig : Advanced Engineering Mathematics, 10^{th} Edition

SEMESTER – IV

STRUCTURAL ANALYSIS-I
CE-401

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand the concept of load calculations for structural analysis
2. identify determinate, indeterminate, stable and unstable structures
3. apply different methods for the determination of slope and deflection in determinate structures
4. determine forces in determinate trusses, beams and frames
5. plot influence lines for beams trusses and three-hinged arches.

SYLLABUS

Unit-I: Forms of Structures

beams, trusses, arches, cables, industrial frames, multistory building frames, shell structure etc.; Loads: DL, imposed loads (LL, WL, seismic load, snow load, erection load etc.); Idealization of structures; types of supports; stability and static determinacy & indeterminacy to beams & frames; free body diagram; Arch structures: 3-hinged parabolic & circular arches, thrust, radial shear and bending moment diagram, spandrel braced arches.

Unit-II: Deflection of beams

Moment area method, conjugate beam method, application of these methods to statically determinate beams & frames; Flexural stiffness of beam with far end pinned & fixed, carry over factor, fixed beams, propped cantilever beam.

Unit-III: Energy methods

Forms of elastic strain energy, axial stress, shearing stress, multi-axial state of stress; Impact load, suddenly applied load, gradually applied load, static load, quasi-static load; Strain energy in members: axial loaded members, under bending, under shearing, circular members under torsion; Law of conservation of energy: virtual work, virtual work on rigid body, virtual work on elastic body; Betti's law and Maxwell's law of reciprocal deflection, application of virtual work on beams (application of product integral table); flexural stiffness of beam with far end pinned; Deflection of statically determinate rigid frames.

Unit-IV: Deflection of pin jointed plane trusses

Method of virtual work; Unit load method; Castigliano's theorems, application of Castigliano's theorems to brackets, lamp posts & curved members; Deflection of truss due to temperature variation; fabrication error and camber.

Unit-V:

Influence Line for Statically determinate structures: Influence Lines, Influence Lines for Beams, Qualitative Influence Lines, and Influence Lines for trusses and three-hinged arches.

Textbook

1. Structural Analysis, by R. C. Hibbeler, Pearsons
2. Structural Analysis by C. S. Reddy, Tata McGrawHill

References

1. Intermediate Structural Analysis by C. K. Wang, Tata McGrawHill
2. Structural Analysis by Pandit& Gupta, Tata McGrawHill
3. Structural Analysis, by T.S., Thandavamoorthy, Oxford Higher Education

HYDRAULICS
CE-402

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. apply concepts of similitude to model investigation
2. analyse laminar and turbulent flow through circular pipes
3. apply momentum equation for the solution of practical problem
4. analyse pipe flow problems through network of pipes
5. design and conduct experiments on pumps and turbine.

SYLLABUS

Unit-I

Dimensional and Model Analysis: Dimensional analysis and its utility; Buckingham's pi-theorem and Raleigh's method and their application to fluid flow problems; Dimensionless parameter in fluid flow and their relevance; Similarities: Application of dynamic similarity to model investigations, scale ratio for distorted model.

Unit-II

Laminar flow: Flow through circular pipes, flow through parallel plates, power absorbed in viscous flow, concept of friction factor, Reynolds's number and its significance; Boundary Layer: Boundary layer along a thin plate and its characteristics, laminar and turbulent boundary layer, laminar sub-layer; Displacement, energy and momentum thickness, separation of boundary layer and its control, drag and lift.

Unit-III

Turbulent Flow: Nature of turbulent flow and its origin, Reynolds's stress, Prandtl's mixing length hypothesis; Momentum integral equation; Hydro dynamically smooth and rough boundaries, Velocity distribution for turbulent flow in smooth and rough pipes; Friction factor in smooth and rough pipes, Moody's diagram, and Colebrook's equation.

Unit-IV

Pipe flow: Hazen William & Darcy Weisbasch equation, minor and major losses, Pipes in series and parallel; Concept of equivalent length, Dupuits equation, , two reservoir problem, pipe network, Hardy cross method, Time of emptying a reservoir through a weir, power transmission through pipes, water hammer.

Unit-V

Turbine: General layout of hydroelectric power plant, impulse and reaction turbines, efficiency of turbines, classification based on discharge, head and specific speed, unit power and unit discharge.

Pumps: Reciprocating Pumps, working principal of both double and single reciprocating pump, indicator diagram frictional loss, centrifugal pump, their advantages over reciprocating pump, classification of centrifugal pump, operation of centrifugal pump in series and parallel.

Textbook

1. Robert L Daugherty, Fluid Mechanics with Engineering Applications, McGraw-Hill

References book

1. John F. Doughlas, Janusz M. Gasiorek, John A. Swaffield, and Lynne B. Jack. Fluid Mechanics, Pearson, 2012
2. Bruce R. Munson, Donald F. Young, and Theodore H. Okiishi, Fundamentals of Fluid Mechanics, 5th Edition, John Wiley and Sons, 2006
3. Modi, P. N. and Seth, S. M. Hydraulics and Fluid Mechanics, Standard Publishing House, Delhi, 2009
4. A.k. Jain Fluid Mechanics, Standard Publishing House, Delhi,

BUILDING CONSTRUCTION
CE-403

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. understand various types of foundation, their functions and essential requirements
2. understand different types of masonry structure and their construction methods
3. apply the knowledge of different types of floors, roofs, stairs and escalators in civil engineering
4. understand various types of doors, windows, lintels, arches, building finishes and formworks with their applications
5. apply the knowledge of damp proofing treatment and sound insulation techniques in buildings

SYLLABUS

Unit -I: Foundation

Functions of Foundations, Essential requirements of a good Foundation, Types of Foundations; Shallow Foundations, Deep Foundations.

Unit -II: Masonry

Stone Masonry and Brick Masonry, Different terms used in Masonry, Bond and its types, Composite Masonry, Panel Walls, Load Bearing Walls, Compound Walls, Cavity Walls, Partition Walls.

Unit -III: Floors and Roofs

Flooring: General Considerations, Different types of Floorings, Flat-Floor and Flat-Roof Construction, Different types of Upper Floors.
Sloped Roofs: Types of Sloped Roofs.
Stairs and Escalators: Requirements of a good stair, Location and Types.

Unit -IV: Doors and Windows

Doors, Windows and Ventilators; Location, Size, Classification and details.
Lintels and Arches: Different types.
Building Finishes: Plastering, Pointing, Painting and Polishing, White/Colorwashing,Plastic Paints.
Formwork: Shuttering and Scaffolding.

Unit -V: Damp Proofing and Water Proofing
Treatment of Floors, Walls and Basement, Miscellaneous Topics- Fire Protection, Thermal and sound Insulation of Buildings.

Textbook
1. Building Construction by BC Punmia& AK Jain
2. Building Construction by PC Varghese
3. Building Construction & Material by Gurcharan Singh
4. Building Construction by Sushil Kumar

GEOMATICS
CE-404

L: 2T: 1 P: 0 Cr: 3

COURSE OUTCOMES
Upon successful completion of the course, a student should be able to:
1. apply the fundamentals of astronomy for mapping to solve real world problem.
2. establish control points and prepare maps on different coordinate and projection systems.
3. apply modern electronics and satellite technology of measurement of distances and coordinates for civil engineering projects.
4. apply basic concepts and principles of photogrammetry for mapping.
5. study dynamic changes on the earth surface using different types of satellites products and overlaying techniques.

SYLLABUS

Unit-I:
Field Astronomy: Astronomical terms, coordinate systems, solution of astronomical triangle; kinds of time, conversion of time; corrections to the observed altitude; determination of azimuth and latitude.

Unit-II:
Triangulation: concept, figures and systems; trigonometrical leveling: plane and geodetic observations; concept of map, coordinate systems, and projections

Unit-III:
Electronic distance measurement (EDM): importance, principle, classification; applications of total station; global navigation satellite system (GNSS): introduction, principle and applications

Unit-IV:
Photogrammetry: introduction, geometric characteristics of aerial photograph, scale of a vertical and tilted photograph; determination of horizontal ground length from photo-coordinates; relief displacement; flight planning; image parallax and stereoscopy.

Unit-V:
Remote Sensing: Introduction, principles, electromagnetic energy and its interaction with matter; sensors and platforms, image interpretation. Geographic information system (GIS): Overview, definition, components, data models.

Text Books
1. Elementary Surveying, Charles D. Ghilani, Paul R. Wolf. 14th Edition, Prentice Hall, 2014.
2. Surveying-Bannister, Raymond and Baker, Pearson Education
3. Remote Sensing and Image Interpretation by Lillesand and Kiefer, John Wiley & Sons, Inc.
4. Principles of Geographic Information Systems by Burrough, P.A. and McDonnell R.A., Oxford: Clarendon Press.

Reference
1. Surveying and Leveling, T. P. Kanetkar and S.V.Kulkarni Vol.1 & 2, VidhyarthiGriha, Prakashan, Pune
2. Plane and Geodetic Surveying for Engineers, David Clark and Jackson J. E., CBS Publications and distributors, New Delhi.
3. Advanced Surveying, Agor, Khanna Publications, Delhi.An Introduction to Geographical Information

ESTIMATING AND COSTING
CE-405

L: 3T:0 P: 0 Cr: 3

COURSE OUTCOMES
1. Students will be familiar with planning of residential buildings.
2. Students will be able to understand the various methods for estimation of buildings.
3. Students will be familiar with the contract system in the civil engineering.
4. Students will be able to understand the computation of earth work and different types of earth works
5. Students will be able to understand the importance of valuation in construction, rent fixation and tenders.

SYLLABUS

Unit-I: Introduction
Definition of estimate, Quantity Survey, plinth area, covered area and floor area estimates, data required for the preparation of estimate, types of estimate, methods of estimating, long wall short wall method and center line method, units of measurements and degree of accuracy in estimating (as per 27- 1984)

Unit-II: Building Estimates
Preliminary estimates of building by given plinth area, floor area and covered area, various forms used in estimating, estimation of two room building by long wall short wall method and center line method.

Unit-III:
Analysis of rates, purpose of analysis rate, to fix up rate per unit of an items, requirement of rate of analysis for materials and labor (skilled & unskilled), factors affecting rate of analysis of rate for concrete work, brick work and plastering.

Unit-IV:
Estimate of multistory building, tender, tender notice, tender form, tender documents, notice inviting tender (NIT), global tender, informal tender, unbalanced tender, abstracting, methods of taking out quantities, computation of earth work.

Unit-V:
Importance of valuation in construction, credential of valuer, classification of value- definition, assessed value, book value, market value, salvage value, scrape value and capitalized value, valuation & purpose of valuation, terms used in valuation.

Textbook
1. Estimating and costing by B N Datta, S S Dutta and Co.
2. Estimating and costing for civil Engineering by G S Birdie
3. Building Drawing by Shah, Kale and Patki
4. Estimating and Costing in Civil Engineering Theory and Practice, by Dutta B.N

NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING
CE-410

L: 3 T: 1 P: 0 Cr: 4

COURSE OUTCOMES
1. Students will be able to interpolate values of a function at a given intermediate value to formulate most of the application problems in science and engineering.
2. Student will be able to interpolate values of successive derivations of a tabulated function and single integral as well as multiple integral provides.
3. Students will be able to find roots of algebraic and transcendental non-linear equations involving one and more variables.
4. Students will be able to solve complex system of simultaneous linear equations and to fit variety of curves.
5. Students will be able to solve higher order differential equation numerically and boundary value problems.

SYLLABUS

Unit-I: Interpolation With Equal & Unequal Intervals Of The Argument
Newton-Gregory, Gauss, Stirling and Bessel Formulae, Aitken & cubic spline interpolation methods for equal intervals; Newton's divided difference and Lagrange's formulae for unequal intervals; Inverse interpolation using.Lagrange's formula, method of successive approximation and double interpolation.

Unit-II: Numerical Differentiation & Numerical Integration
Numerical successive differentiation using Forward, Backward, Central difference interpolation formulae. Newton's divided difference formula. Review of Trapezoidal, Simpson's 1/3 and 3/8 rules, Numerical integration using Boole's rule, Weddle's rule, Gauss-Legendre, Lobatto, Radau and Gauss-Chebyshev rules. Errors in Quadrature formulae, Romberg integration and Numerical double integration.

Unit-III: Numerical Solutions Of Algebraic & Transcendental Equations
Bisection, Regula-False position, Newton-Raphson &Graeffe's Root-Squaring method for the solution of non-linear algebraic & transcendental equations involving one variable, rate of

Convergence and error analysis of the methods, Newton-Raphson method for the solution of a system of non-linear equations of two variables.

Unit-IV: Numerical Solution Of A System Of Simultaneous Linear Equations & Curve Fitting
Gauss Elimination & Gauss-Jordan methods, III conditioned linear system, Gauss-Seidal and Crout methods for the solution of a system of linear equations in four unknowns; General curves (linear, quadratic, exponential and other non-linear functions) fitting using methods of least squares.

Unit-V: Numerical Solutions Of Ordinary Differential Equations & Boundary Value Problems
Numerical approximate solutions of a system of simultaneous and higher order differential equation using Taylor's series method, Picard's method and Runge-Kutta fourth order method; Runge-Kutta, Fehlberg method, Modified Euler and Milne methods; Solution of boundary value problems using finite differences method and cubic spline method.

Textbook

1. M.K. Jain, S.R.K. Iyengar& R.K. Jain: "Numerical Methods for Scientific and Engineering Computation", 4th Edition, New
2. Age International Publisher, Daryaganj, New Delhi-01
3. S.S.Sastry: "Introductory Methods of Numerical Analysis", 4th edition, Prentice Hall of India, Jhilmil House, Patparganj, New Delhi.
4. Steven C. Chapra& Raymond P. Canal, "Numerical Methods for Engineers", Tata McGraw Hill Book Co.
5. V. Rajaraman, "Computer Oriented Numerical Methods", Prentice Hall of India Pvt. Ltd.
6. Madhumangal Pal, "Numerical Analysis for Scientists & Engineers, Theory & C Programs", Narosa Publishing House, Daryaganj, New Delhi – 110002.
7. Shanta Kumar M, "Computer Based Numerical Analysis", Khanna Publishers, Delhi – 110002.
8. B.S. Grewal, "Numerical Methods in Engineering & Science with Programming in C/C++", Khanna Publishers.
9. Radhey S. Gupta; "Elements of Numerical Analysis", Macmillan India Ltd.

SEMESTER – V

STRUCTURAL ANALYSIS-II
CE-501

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

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

1. analyse indeterminate beams, frames and trusses (degree one & two) by using Force/ Flexibility/ Compatibility/ Consistent Deformation Methods.
2. analyse the beams for symmetrical/ unsymmetrical bending; and analyse cables; suspension bridges with three & two hinged stiffeneing girders.
3. analyse continuous beams/ intermediate beams and frames (sway problems) by using Three Moment Theorem and Slope Deflection Methods.
4. analyse fixed beams/ portal frames by Column Analogy method and analyse Indeterminate Trusses, Mill Bents, portal frames, continuous beams and building frames by Cantilever and Portal methods.
5. analyse different structures by developing Stiffness/ Displacement matrices.

SYLLABUS

Unit-I: Introduction:
Force / flexibility / compatibility / consistent deformation method of analysis ;Superposition, compatibility & equilibrium, flexibility coefficients, flexibility matrices, application of the method to indeterminate beams, frames and trusses to degree one & two.

Unit-II: Unsymmetrical bending
Introduction, double symmetric beams with skew loads, pure bending, shear flow and shear center; Analysis of cables; Analysis of suspension bridges with three & two hinged stiffening girders.

Unit-III: Indeterminate Structures
Continuous beam- Three Moment Theorem; Slope deflection method and its application to analysis of indeterminate beams & frames, yielding of supports, sway problems.

Unit-IV: Column analogy method
Application to fixed beams, properties of symmetrical analogous column, analysis of portal frames.
Approximate analysis of statically indeterminate structures: Indeterminate Trusses, Mill Bents, portal frames, continuous beams and building frames, cantilever method and portal method.

Unit-V: Stiffness/ Displacement method
Development of stiffness matrix for pin jointed structure and frames, development of method for a structure having forces at all degrees of freedom, development of method for a general case, direct stiffness method.

Textbook

1. Intermediat Structure Analysis By C.K. Wang, Tata McGraw-Hill.
2. Structure Analysis ByPandit& Gupta, Tata McGraw-Hill.
3. Basic Structural Analysis By C.S. Reddy, Tata McGraw-Hill.
4. Structure Analysis ByThandavamoorthy, Oxford

References

1. Structure Analysis By Norris & Wilbur.
2. Basic Concepts of Structure Analysis By Beaufait, F.W.

3. Examples in Structural AnalysBy William M. C. McKenzi.

DESIGN OF STRUCTURE I
CE-502

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. understand the importance of RC structural design basic concept, working stress method.
2. apply the theory of limit state design of RCC structural members using first principles.
3. have adequate understandings of relevant Shear.
4. gain knowledge about Indian standards, use of design charts & table for design of beams and slabs.

SYLLABUS

Unit-I:

Characteristic strength, stress-strain relationship for concrete and steel, IS specifications (IS 456, 875 & 1893), characteristic imposed loads, DL, EL & WL. Design philosophies – Working stress method and limit state method. Strength and serviceability requirements, Analysis and design for flexure of singly / doubly rectangular and flanged beam sections – by working stress method.

Unit-II:

Analysis and design for flexure of singly / doubly rectangular and flanged beam sections – by limit state method. Serviceability limit states for deflection and cracking, requirements for curtailments and detailing of reinforcement, minimum / maximum tension and compression reinforcement, minimum& maximum spacing of bars; Introduction and use of design aid (SP-16), calculation of deflection.

Unit-III:

Bond stress: flexural & anchorage bond stress, design bond stress, development length, anchorage length; Behaviour of beams in shear, design for shear & torsion as per limit state method; Reinforcement detailing.

Unit-IV:

Complete design of a cantilever and simply supported beam with and without overhang; Design of continuous beams with Rectangular, T & L sections; Introduction to slabs: rectangular slab, one way simply supported & continuous slab and their design; Comparison of manual design with the software available.

Textbook

1. R. C. C. Design by Pillai and Menon, Tata McGraw Hill
2. Reinforced Concrete Design by S. N. Sinha, Tata McGraw Hill
3. Limit State Design by P. C. Verghese, Prentice Hall
4. Reinforced Concrete Limit State Design , Ashok K Jain Namechand& Bros Rorkee

References

1. Structural Analysis by Norris, Wilbur
2. “Code of Practice for Plain and Reinforced Concrete”, BIS, New Delhi, IS456-2000.

3. "Design Aids for Reinforced Concrete to IS 456", Special Publication (SP16), BIS New Delhi,1980.
4. "IS: 1343- 1980, IS Code Of Practice For Prestressed Concrete", BIS, New Delhi, 1980

DESIGN OF STRUCTURE II
CE-503

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. learn the concept of analysis and design of steel structures.
2. analyze and design of bolted and welded connections.
3. analyze and design of tension members with different failure criteria.
4. analyze and design of columns/buit up columns with various configurations and end conditions.
5. analyze and design of laterally supported and unsupported beams.

SYLLABUS

Unit-I: Design of Connections

Common steel structure, advantages and disadvantages of steel structures, type of steel, rolled steel sections, special considerations in steel design, design philosophy, limit state design, design strength, deflection and serviceability limits, stability checks; Riveted, bolted and welded connections, classification of bolts and types of bolted connections, **IS 800-2007** specifications for design of bolted connections, worked examples on design of bolted joint, shear capacity and tension resistance of bolts **(IS-1364)**, design examples of fillet and butt weld connections, design of eccentric bolted and welded connections.

Unit-II: Design of Tension members

Design strength of tension member due to yielding of gross section, rupture strength of critical section and block shear, tension splices and lug angles; design of bolted and welded connections for ties subjected to both bending and axial tension.

Unit-III: Design of Compression members

Shape of compression members, buckling class of cross–section, slenderness ratio, design compressive stresses and strengths, use of IS800-2007 tables for design stresses, design of compression members, design of laced and battened columns, design of column splices; Column bases: design of slab base and gusseted base.

Unit-IV: Design of Beams

Behavior of beam in flexure, section classification, plastic moment carrying capacity of a section, bending and shear strengths of laterally supported beams, design of laterally supported beams, deflection limits, web buckling and web crippling, design of built-up beams, design strength of laterally unsupported beams, effective lengths for lateral torsional buckling, design of laterally unsupported beams.

Textbook

1. Limit State Design of Steel Structures, SK Duggal, Tata Mac-Graw-Hill Publication-2010.
2. Limit-State-Design of Steel Structures by N. Subramanium, OxfordUniversity Press-2009
3. Strength of Materials by B C Punmia.

References

1. IS 456-2000: Code of practice for plain and R. C. BIS, New Delhi.
2. I.S.800:2007,"Code for general construction in steel structures," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
3. I.S.875 (part I to part V)," Code Of Practice For. Design Loads," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
4. I.S.226," Steel for general structural purposes," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
5. I.S.808:1989,"Code for Classification of Hot Rolled Steel ," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
6. I.S.226," Steel for general structural purposes," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
7. I.S.808:1989,"Code for Classification of Hot Rolled Steel ," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.
8. I.S.816:1969," Code of practice for use of metal arc welding for general construction in mild steel," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah Zafar Marg, New Delhi.

OPEN CHANNEL FLOW
CE-504

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand geometrical properties of channel sections of different shape.
2. apply the concept of specific energy in the analysis of channel transitions.
3. understand and analyze flow profiles on different sloped channels.
4. analyze rapidly flow problems with focus on practical applications to real-world problems.
5. understand the importance of devices used in the measurement of flow through channels.

SYLLABUS

Unit-I

Introduction: classification of open channel flow. Geometric properties of channel section, Velocity and Pressure distribution in Channel Flow, Kinetic energy and momentum correction factors. Uniform flow, Application of Manning's and Chezy's formulae.

Unit-II

Specific Energy**:** Critical Flow, Specific Energy and Force. Transitions in channels, channel with a hump, transition with change in width, choking flow. Channel conveyance, section factor for critical flow and uniform flow computations. Most economical section of a channel.

Unit-III

Gradually varied flow: Gradually varied flow equation, assumptions and different forms of the equation, characteristics and classification of flow profiles. Analysis of flow profiles on mild, steep, horizontal and adverse slopes. Solution of the gradually varied flow equation, Graphical integration method, Direct step method.

Unit-IV

Rapidly varied Flow**:** Hydraulic Jump, its definition and types. Momentum equation for the jump, characteristics of jump in horizontal rectangular channel, computation of energy loss and length, location of jump, and pressure distribution, energy dissipaters

Unit V
Measuring devices in open channel: Flow in channels with sharp & broad crested weir. Flow measurement with non rectangular weirs; Triangular, circular and parabolic weir. Discharge using linear proportional weir, Sutro weirs, Quadratic weir, Ogee spillway and sluice gate.

Textbook
1. Open channel flow by V.T Chow. McGraw Hill.

References
1. Flow in Open channels by K Subramanya.Tata McGraw- Hill.
2. Flow in Open channels by RangaRaju.Tata McGraw- Hill.

SOIL MECHANICS
CE-505

L: 3 T: 1 P:0 Cr: 4

COURSE OUTCOMES
At the end of the course work, the students will be able to:

1. understand soil identification, index properties and their determination, and phase diagram of the soil.
2. solve 1-D, and 2-D problems of flow through soils.
3. calculate vertical stresses in the soils due to overburden and applied loads
4. interpret compaction and consolidation characteristics of different soils.
5. evaluate shear strength parameters of the soils and their application in geotechnical problems.

SYLLABUS

Unit-1: Classification and Properties
Origin and formation of soils, Soil Structure and Fabric, Three Phase System and Phase Relationships, Classification: Unified and IS Classification System, Index Properties

Unit-II: Flow Through Soils
Permeability, one dimensional flow, Darcy's Law, Two dimensional flow, Flow nets, uplift pressure, piping

Unit-III: Stresses in Soil
Total, Neutral and Effective Stresses, Seepage Force, Quicksand condition, Stress Distribution under applied loads: Boussinesq's and Westergaard's Equations, Newmark's Chart

Unit-IV: Compaction and Consolidation
Compaction: Lab and Field Compaction, Proctor Compaction Tests; Compressibility, One dimensional consolidation and its time rate.

Unit-V: Shear Strength and Lateral Earth Pressure
Shear Strength: Mohr-Coulomb strength criteria, Direct and Triaxial shear tests, Vane Shear Test, Unconfined Compression Test, Drainage Conditions, Stress Paths, Shear Strength Parameters.

Textbook

1. Soil Mechanics and Foundation Engineering by K R Arora, Standard Publishers Distributor
2. Soil Mechanics and Foundation by Punmia, Jain and Jain; Laxmi Publications (P) Ltd.
3. Engineering Properties of Soils by S K Gulati, Tata McGrawhill

Environmental Engineering – I
CE-506

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand various important parameters required for design of water supply systems
2. understand design of various components of water supply systems
3. understand important water quality parameters
4. understand basic principles and design philosophies of various treatment operations and process
5. understand advanced methods of water treatment

SYLLABUS

Unit-I:
Water demand: Types of demands, factors affecting per capita demand, variations in demand; Population forecasting; Sources of water supply: estimation of water quantity, factors governing the selection of source; Water conservation measures.

Unit-II:
Intakes: Types of intakes, factors governing the location of intake; Reservoirs: types of reservoirs, capacity of reservoir; Water distribution system: requirements of a good distribution system, methods of distribution, layout and design of water supply systems; Pipes: types of pipes for transporting water, pipe appurtenances, testing of pipelines.

Unit-III:
Water Quality: Physical chemical and microbiological water quality parameters and their significance; Water borne diseases and their control; drinking water quality criteria and standards; Natural processes occurring for self-cleansing of water bodies; Engineered systems of water treatment

Unit-IV:
Aeration: Mechanics of gas transfer, types of aerators, applications of aeration; Sedimentation: theory of sedimentation, design of sedimentation tank, types of sedimentation tanks; Coagulation: theory of coagulation, types of coagulants and coagulant aids, and flocculation, design of flocculation tank.

Unit-V:
Water softening: Chemical precipitation, ion exchange; reverse osmosis; Filtration: theory of filtration, types of filters and their classification, filter operations; disinfectioning: types of disinfectants, chlorination; Site selection for treatment plant; layout considerations for treatment plant; Operation and maintenance of treatment plants.

Textbooks

1. Modi PN,Water Supply Engineering (Environmental Engieering-I),Standard Book House, 2010

2. Garg Santosh Kumar, Water Supply Engieering

References

1. Qasim Syed R, Motely Edward M, Zhu Guang, Water Supply Engineering, PrenticHall of India 2006
2. Peavy Howard S, Rowe Donald R, TchobanglousGeroge, Environmental Engineering, McGraw Hill Education (India) Pvt Ltd 2013
3. SinceroArcadio P, SinceroGregoria A, Environmental Engineering – A Design Approach, Prentice Hall of India 2010
4. Gray NF, Water Technology – An Introduction for Environmental Scientists and Engineers, Elsvier, 2nd Ed.
5. Davis Machenzie L, Water and Wastewater Engineering – Design Principles and Practice, McGraw Hill Education (India) Pvt Ltd 2014
6. CPHEEO, Manual on Water Supply and Treatment, Central Public Health and Environmental Engineering Organization, Ministry of Urban Development, Government of India.
7. Walter J, Weber Jr, Physicochemical Processes for Water Quality Control, John Wiley & Sons, 1972

SEMESTER – VI

STRUCTURAL ANALYSIS III
CE-601

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

1. To analyze structures subjected to rolling loads.
2. To analyze beams, portal frames and gable frames using moment distribution method
3. To analyze beams using plastic theory
4. To apply basic concepts of structural dynamics for the analysis of structures
5. To analyze the behavior of two-hinged and fixed arches

SYLLABUS

Unit-I: ILD and its application
Single concentrated load, UDL (shorter and longer than span), two concentrated loads, series of concentrated loads for maximum shear force at a section, BM under a given load, maximum BM at a given section, absolute maximum shear & moment in beams; Muller Breslau principle and its application

Unit-II: Moment distribution method
Member stiffness factor, joint stiffness factor, carry over factor, distribution factor, procedure for analysis, application to continuous beams and frames with and without sway, symmetrical and unsymmetrical frames

Unit-III : Plastic Analysis
Basis of plastic theory, bending of beams symmetrical about both axes, fundamental conditions for plastic analysis, rigid plastic analysis, analysis of beams and frames

Unit-IV: Structural Dynamics
Introduction, various terms used in the vibration analysis: Simple harmonic motion, free or natural vibrations, damping, damping coefficient, mass and stiffness.

Unit-V: Two-hinged and hingeless arch
analysis of symmetrical arch, temperature effect, elastic centre method

Text Books

1. Intermediate Structural Analysis by C. K. Wang, Tata McGrawHill
2. Structural Analysis by Pandit& Gupta, Tata McGrawHill
3. Strength of Materials by B C Punmia
4. Structural Analysis by B C Punmia

Reference Books

1. Structural Analysis by Norris, Wilbur
2. Structural Dynamics by M Mukhopadhyaya
3. Dynamics of Structures by Chopra
4. Earthquake Resistant Design of Structures By Pankaj Agarwal and Manish Shrikhande, Publication, Prentice Hall of India Pvt. Ltd.
5. Seismic Analysis of Structures by T K Datta, Wiley

Software or other Requirement

1. STAAD Pro

DESIGN OF STRUCTURE III
CE-602

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, a student should be able to:

1. assess the load criteria and design of RCC slab and staircases.
2. design reinforced concrete short and long columns subjected to uni-axial and bi-axial compression.
3. select the most suitable section shape and size for Plate girder and design according to specific design criteria.
4. analyse and design roof trusses & estimation of wind load. Design of gantry girder for different loading combinations.

SYLLABUS

Unit-I: Design of slabs and stairs

Various type of slabs and their behavior, design of two- way rectangular slabs with different boundary conditions, use of moment coefficients, provision for corner reinforcement; Design of stairs.

Unit-II: Design of Columns

Columns, various cross sections, effective length, slenderness ratio, short and long columns, design of columns under axial compression, uni-axial and bi-axial compressions, uses of interaction curves ofSP16 for column design.

Unit-III: Plate girder

Elements of plate girder, self weight of plate girder, economical depth, size of flanges, shear buckling resistance of web, end panel design, anchor forces, design of connections between flanges and web plates, design of bearing and intermediate stiffeners, and their connections with web; Design of plate girders.

Unit-IV: Roof Trusses

Types of roof trusses, loads on trusses:wind load estimation, snow load, live load and load combinations,bracings, spacing of trusses, purlins, sheetings, analysis of trusses, grouping of members, design of members, bolted joints and end bearings.

Unit-IV: Gantry Girder

Loads for gantry girders, position of moving load for maximum effect, profile of gantry girders, limitation on vertical deflection, design procedure of gantry girder.

Textbook

1. Limit State Design of Steel Structures, SK Duggal.Tata Mac-Graw-Hill Publication-2010.
2. Limit-State-Design of Steel Structures by N.Subramanium-2009, Oxford University Press.
3. Limit State Design of Concrete Structures by Verghees, Vol. 1.

References

1. Reinforced Concrete Design, by S U Pillai and Devdas Menon, Tata-McGraw-Hill Publishing Company Limited, New Delhi.
2. Comprehensive Design of RCC Structures, by B C Punmia, A K Jain and A K Jain,Laxmi Publications (P) Ltd, New Delhi
3. Design of Reinforced Concrete Structures, by SRamamrutham, Dhanpat Rai Publishing Company, New delhi,
4. Limit State Theory and design of reinforced Concrete, by V L Shah and S R Karve, Structures Publications, Pune, 2011

5. Reinforced Concrete Structures, by Park R and Paulay T, John Wiley & Sons, Inc., New York, 1975
6. IS 456: 2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi

ENGINEERING HYDROLOGY
CE-603

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand various components of hydrological cycle
2. estimate various abstractions from precipitation such as evapotranspiration and infiltration
3. derive relationship between rainfall and runoff using statistical techniques and plot stage-discharge relationship
4. derive unit hydrographs of different durations, and develop synthetic unit hydrographs
5. apply the technique of flood routing for the mitigation of floods in channels

SYLLABUS

Unit-I

Precipitation: Hydrologic cycle, World's Water balance, Types and Forms of precipitation. Measurement of precipitation. Adequacy of rain gauges. Average rainfall over an area.

Unit-II

Evaporation: Evaporation process, Transpiration, Evapotranspiration, measurement of evapotranspiration- Thornwaite and Balaney criddle methods. Evaporation Control. Infiltration: Infiltration Process, factors affecting infiltration, measurement of infiltration, infiltration indicies

Unit-III

Surface Runoff: Factors affecting runoff. Rainfall – runoff relationships, empirical equations. Flow duration Curve. Stream Gauging: Measurement of stage, velocity. Direct and indirect methods of stream flow measurement. Rating curve, Stage discharge relationship.

Unit-IV

Hydrograph: Introduction, Base flow separation. Unit hydrograph. Derivation of unit hydrograph for simple and complex storms. Unit hydrograph of different durations.

Unit-V

Flood: Flood flow formulae, Design flood Frequency analysis using external type and log Pearson type III distribution. Flood Routing: Basic equation, Hydrologic storage routing in reservoirs and channels.

Textbook

1. Engineering Hydrology by K Subramanya, Tata McGraw- Hill.

References

1. Elementary Hydrology by V. P. Singh, Prentice Hall
2. Hydrology for Engineers by Linsely R. k. Tata McGraw- Hill.

3. Hand book of Applied Hydrology by V.T. Chow. Tata McGraw- Hill.

GEOTECHNICAL ENGINEERING
CE-604

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

The student will be able to

1. compute lateral earth pressures exerted.
2. analyse stability of slopes.
3. calculate bearing capacity of the shallow foundation by using different theories.
4. interpret the data obtained from the geotechnical investigations.
5. judge the appropriate use of geotextiles to improve their properties as per the requirement.

SYLLABUS

Unit- I

Lateral earth pressures; Rankine's Theory for lateral earth pressure computation (active and passive cases), effect of surcharge loading, water table fluctuations and soil stratification, computation of total lateral thrust and location of resultant earth pressure on earth retaining wall, estimation of depth of unsupported vertical cut in Cohesive backfills.

Unit -II

Stability of slopes; basis of analysis, different factors of safety, finite and infinite slopes, types of slope failures, stability analysis of infinite slopes of cohensionless and cohesive soils, stability analysis of finite slopes with Swedish circle method and Taylor's stability chart/number and improving stability of slopes. Causes of landslides and remedial measures.

Unit- III

Introduction to foundation & bearing capacity of soils; basic definitions-ultimate, net-ultimate, net safe and safe bearing capacities, allowable bearing pressure, load-settlement curve, types of shear failures of foundation soils, Terzaghi's bearing capacity theory for a shallow strip footing, ultimate bearing capacity for local shear failure, comparison of Terzaghi's& Meyerhof's Theories, effect of water table fluctuations, shape size and depth of footing, eccentric and inclined loading on bearing capacity of shallow foundation.

Unit -IV

Purpose extent and methods of site investigation, Boring and sampling techniques, Samplers Boring records – Ground water observations, Plate load test, Penetration tests (standard penetration test Static & Dynamic Cone penetration test IS Codes: 1888 (Pt-I), 2131, 4968 (Pt-I, III) Geophysical methods; Seismic and soil resistivity method.

Unit- V

Types of geotextiles, applications in separators, reinforcement, filtration/drainage, erosion control etc. Construction methods of retaining walls with reinforced backfill. Shallow foundations on reinforced earth (improving bearing capacity and reducing settlement).

Textbook

1. Soil Mechanics and Foundation Engineering by K R Arora, Standard Publishers Distributor.

2. Soil Mechanics and Foundation Engineering by Punmia, Jain and Jain; Laxmi Publications (P) Ltd.
3. Engineering Properties of Soils by S. K. Gulati, Tata McGraw Hills.

References

1. Principles of Geotechnical Engineering by B. M. Das & Khaled Sobhan, CENGAGE Learning Custom Publishing.
2. Soil Mechanics by T.W. Lambe and R.V. Whitman, John Wiley & Sons.
3. NPTEL Lectures on Soil Mechanics and Geotechnical Engineering.

ENVIRONMENTAL ENGG - II
CE-605

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the students will be able to:

1. understand the importance of wastewater treatment and reuse & safe disposal.
2. have adequate understanding of the mechanisms of wastewater treatment
3. have understanding of disposal of treated effluent and its reuse
4. understand the importance of sludge treatment and its reuse
5. analyze and design the treatment facility and safe sludge handling

SYLLABUS

UNIT-1: Wastewater Engineering

An overview; constituents in wastewater, different sources of wastewater: domestic, industrial and storm water; types of sewerage and drainage system; Estimation of wastewater flow rates and its variations: Estimation of peak, average and lean flow; drainage discharge; Hydraulics of sewers; Design of wastewater collection systems; Design of storm water drains, Rainwater harvesting system and its design

UNIT-II: Wastewater Characteristics

Physical, chemical and microbiological characteristics of wastewaters; typical characteristics of sewage: decay of sewage relative stability, population equivalent, effluent discharge standards; Eutrophication; Response of streams to biodegradable organic waste: dissolved oxygen balance and its modeling, factor affecting steam flow rejuvenation

UNIT-III: Classification of Treatment Process

Primary, secondary and tertiary treatment; types of screens and its design, assessment of head loss through screen, classification of grit chambers, its application and design, oil and grease removal; Design of primary and secondary clarifiers/ sedimentation tank; Tertiary Treatment: Polishing techniques used after secondary treatment/ effluents

UNIT-IV: Secondary/ Biological Treatment of Sewage

Theory of biological treatment: Microbial growth kinetics, suspended and attached growth systems: Aerobic Treatment-Activated Sludge Process and its modifications, Trickling Filter/Bio Towers and Rotating Biological contractors;Anaerobic Treatment-Upflow Anaerobic Sludge Blanket Process

UNIT-V: Sludge Management and its Disposal
Regulation for reuse and disposal of solids; Sudge thickening and its digestion; Low cost sanitation: decentralized wastewater treatment - stabilization ponds, aerated lagoons, oxidation ditch; Reuse of treated effluents; Concepts of zero discharge

Textbook

1. Environmental Engineering, Peavy, Rowe &Tchobanoglobus, McGraw Hill
2. Introduction to Environmental Engineering, Davis & Cornwell, McGraw Hill
3. Wastewater Engineering Treatment & Reuse, Metcalf & Eddy, McGraw Hill, USA
4. Environmental Engineering- A design Approach ,Sincero&Sincero, Prentice Hall of India
5. Wastewater Treatment Plants: Planning, Designing and Operation,S.R.Qasim, CRC Press, USA
6. Wastewater Treatment for Pollution Control and Reuse, Soli J. Arceivala&Asolekar, Tata McGraw Hill, India
7. Post Treatment of Anaerobically Treated Effluents, V.K.Tyagi, Abid Ali Khan, Anwar Khursheed, A.A.Kazmi, Ng WunJern, IWA Publishing, UK

TRANSPORTATION ENGINEERING
CE-606

L: 3T: 0 P: 0 Cr: 3

COURSE OUTCOMES
Upon successful completion of the course students should be able to:

1. gain knowledge on highway planning, alignment surveys and project preparation.
2. learn basic concepts of highway geometrics and geometric design of roads and intersections.
3. understand basic concepts, analysis and design of traffic flow and traffic facilities.
4. gain knowledge of different highway materials and their characteristics. Design of mix and flexible pavements using IRC Codes.
5. design the rigid pavements using IRC Codes. Gain knowledge of construction, maintenance and drainage of highways.

SYLLABUS

Unit-I: Introduction
Importance of Transportation, Different modes of transportation, Brief history of road development around the world. Twenty year road development plans, Necessity of highway planning, Road patterns, Preparation of Master Plan and its phasing, Highway alignment, Engineering and other surveys for highway location, Highway projects evaluation.

Unit-II: Highway Geometric Design
Introduction Design speed, Highway cross – section elements, Analysis of sight distances, Design of horizontal and vertical alignments – all pertinent elements, Types of intersection, Principles of intersection design.

Unit-III: Traffic Engineering
Traffic characteristics, traffic studies – volume, speed, origin and destination, parking and accident studies, Traffic controls- traffic signs, marking and traffic signals, Highway capacity, Signal design.

Unit-IV: Highway Materials
Subgrade soil, aggregates and bituminous material; different tests on these materials. Bituminous mix design, pavement types, Soil stabilized roads. Pavement design: Introduction, Design parameters, Design of flexible pavement (IRC method).

Unit-V:
Design of rigid pavement (IRC method), construction of WBM road, bituminous pavements and cement concrete pavement, Highway maintenance and drainage.

Textbooks
1. Highway Engineering by Khanna, Justo and Veeraragavan, Nem Chand and Bros, Roorkee.
2. Transportation Engineering by Chakroborty and Das, PHI.
3. Relevant IRC codes.

References
1. Transportation Engineering and Planning by Papacostas and Prevedouros, PHI.
2. Pavement analysis and design by Y H Huang, Pearson Prentice Hall.
3. Specifications for roads and bridges by MoRTH (Ministry of Road Transport and Highways, Govt of India, V Revision)

SEMESTER – VII

DESIGN OF STRUCTURE IV
CE-701

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. design different types of footings and retaining walls
2. design different types of water tanks
3. design different types of bridges and culverts
4. analyse and design prestressed concrete structures

SYLLABUS

Unit-I: Foundation and their types

Detailed design of Isolated and combined footing, design of wall footings. Retaining walls: Cantilever and Counter fort type, their design using limit state method.

Unit-II: Water tanks

Design criteria, material specifications and permissible stresses; IS 3370 (Pt. 1, Pt.2, Pt. IV) 2009; Design of circular and rectangular water tanks resting on ground & underground using working stress approach, cracking width in immature concrete and mature concrete in flexure and direct tension.

Unit-III: Bridges

Introduction, various types, super-structures, sub-structures, IRC loadings; Design of deck slab of culvert, Design of T-beam Bridge. Introduction to prestress concrete bridge.

Unit-IV: Prestressed concrete

Methods and systems, anchorages, prestress losses, analysis and design of sections for flexure based on working stress.

Textbook

1. Pillai S. Unnikrishna and Menon Devdas, Reinforced Concrete Design, McGraw-Hill, 3rd edition, 2015.

References

1. Lin, T.Y. and Burns H. Ned, Design of Prestressed Concrete Structures, Wiley, 2012
2. Victor D. J. 5th Edition, Essentials of Bridge Engineering, Wiley, 2006
3. Raju N. Krishna, Design of Reinforced Concrete Structures, CBS Publishers and Distributers Pvt Ltd, 4th ed., 2016
4. Sharma N., Reinforced Cement Concrete Design, Katson Books, 2014.

IRRIGATION ENGINEERING
CE-702

L: 3 P: 0 T: 0 **Cr: 3**

COURSE OUTCOME

Upon the completion of course, students will be able to

1. underline the irrigation needs and planning ;
2. estimate water requirements of crops and irrigation water requirements;
3. design the canal system and identify the needs of various hydraulic structures;
4. analyze the subsurface flow and be able to design weir, canal falls, cross drainage works;
5. assess the remedial measures for water logging and design of lined canal.

SYLLABUS

Unit- I:

Irrigation in India – Necessity, scope of irrigation, irrigation schemes, ongoing projects, engineering aspects of project planning; Water application – crop types, water requirements and its estimation, water application efficiencies and techniques of field irrigation.

Unit-II:

Design of Alluvium Channels, Silt theories – problems of silting and scouring, Kennedy's theory, design procedure, drawbacks, Lacey's silt theory, channel design procedure, drawbacks, Comparison between Kennedy's and Lacey's theory, Lacey's non-regime equation, L-section of a channel, balancing depth, Use of Garret's diagram, Cross-section of irrigation channels.

Unit-III:

Weirs and barrages – components, functions, causes of failure; Bligh's creep theory, Lanes's weighted creep theory, Khosla's theory, pressure calculations, Design – sloping glacis weir and protection works,.

Unit-IV:

Water logging – effects of water logging, causes of water logging and their remedial measures. Canal lining – advantages, types of lining, and design of lined channels. Regulation works.
Canal falls, types of falls, Design of Sarda type fall.

Unit-V:

Cross-Drainage works, Types of works, factors affecting the suitability of CD works, classifications of aqueducts and siphon aqueducts, Design- maximum flood discharge, water way, transitions, head losses, uplift pressures etc.

Textbooks

1. Irrigation, Water Resources and Power Engineering by P.N. Modi , Standard Book House, Delhi , Latest edition.
2. Irrigation Engineering and Hydraulic Structures by S.K. Garg, Khanna Publishers, Lates edition

References

1. Irrigation and Water Resources Engineering by G.L. Asawa, New Age International Publishers
2. Theory and Design of Irrigation Structures by ByVarshney and Gupta, Vol. I and II,
3. Hydraulic Structures by Novak, P. , AIB Moffat and Nalluri and R Narayanan, Taylor and Francis
4. NPTEL

FOUNDATION ENGINEERING
CE-703

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. analyse and design of earth retaining structures.
2. interpret soil investigation data and be able to calculate bearing capacity of foundations.
3. design shallow foundations.
4. design deep foundations viz. pile foundations, well foundations.
5. understand soil dynamics and analyse the foundations subjected to dynamic loadings.

SYLLABUS

Unit-I: Earth Retaining Structures-1

Introduction to Coulomb's earth pressure theory and other graphical methods for cohesive and granular soil. Classification of earth retaining structures (Rigid and Flexible). Analysis of Retaining Walls: Cantilever, Counterfort and Buttress.

Unit -II: Earth Retaining Structures-2

Analysis of Sheet pile walls, bulkheads, and anchored sheet pile. Stability Analysis and Design of Braced Excavations.

Unit- III: Shallow Foundations

Types and general requirements of shallow foundation; Bearing capacity consideration, settlements of foundations, I.S. Code recommendations. (I.S. 6403, 8009). Design of shallow foundations.

Unit- IV: Deep Foundations

Types, purpose and classification of pile foundations: Construction of piles, pile load test, load capacity and settlement of piles; Design of Pile foundations, use of relevant I.S. Code (I.S. 2911: Part I-IV); Well foundation: Types, element and construction well foundation, principles of design.

Unit- V: Soil Dynamics & Machine Foundations

Introduction to soil dynamic, definitions, spring mass system, single degree of freedom system, free and forced vibration of damped and undamped systems; Types & criteria for design of machine foundations. Analysis and design of block foundation; Vibration isolation (active and passive method).

Textbook

1. Design of foundation and Retaining Structures By S. Prakash, G Ranjan& S Saran; SaritaPracashan, Meerut
2. Soil Dynamics By Shamsher Prakash; McGra Hill, London
3. Soil Mechanics and Foundations By B C Punmia& Ashok Kumar Jain; Laxmi Publications, Delhi
4. Environmental Engineering – A Design Approach, Sincero&Sincero, Prentice Hall of India

References

1. Basic and applied soil mechanics, Gopal Ranjan and Rao A.S.R., New Age International Publishers
2. Geotechnical Engineering, Venkatramiah, New Age International Publishers
3. Geotechnical Engineering, Shashi K. Gulhati and Manoj Dutta, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Foundation Engineering, Leonards G.A., McGraw Hill
5. Foundation Design, Teng W.C., PHI

ENGINEERING ECONOMY& CONSTRUCTION MANAGEMENT
CE-704

L: 3 T: 1 P: 0 Cr: 4

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand and calculate economic equivalence and to be able to Identify and use some excel functions commonly applied in engineering economics.
2. evaluate most engineering project proposals using a well-accepted economic analysis techniques.
3. understand structure of construction organization and its functions, labour laws and to be able to understand the use and selection of construction equipment
4. learn the application of basic network technique of PERT in construction management.
5. Learn the application of basic network technique of CPM in construction management.

SYLLABUS

Unit-I:

Basic concepts of engineering economics, cash flow diagram, minimum attractive rate of return, single payment, uniform series and gradient series factors – their derivation and use, nominal and effective interest rates, use of multiple factors, depreciation and depletion, present worth comparison of equal and different lived alternatives**.**

Unit-II:

Capitalized cost calculation, annual worth (AW) evaluation using salvage sinking fund, salvage present worth and capital recovery plus interest method, comparing alternatives by AW, rate of return evaluation by present worth and AW method, benefit/ cost ratio analysis

Unit-III:

Overview of construction industry, structure of construction organization and its functions, management functions and responsibilities, labour relations, construction equipment: power shovel hoe, bulldozer, dumper, trailers, and tractors, rollers, sheep foot roller, batching plants.

Unit-IV:

Planning, scheduling , basic network techniques, Gantt charts, PERT Network, time estimates, probability distribution, time computations, earliest expected time, latest allowable occurrence time, network analysis, slack, critical path.

Unit-V:

CPM network, floats, crashing a network, introduction to precedence networks.

Textbooks

1. Engineering Economy by Leland T. Blank, Anthony J. Tarquin, McGraw-Hill Book Company, New Delhi.
2. PERT and CPM by L.S.Srinath ,Affilated East-West Press Pvt. Ltd, New Delhi.

References

1. Construction Planning, Equipment and Methods by Robert L. Peurifoy, William B. Ledbetter, Clifford J. Schexnayder, McGraw-Hill Book Company, New Delhi.
2. Fundamentals of Construction Management and Organization by Kwaku A. Tenah Jose M. Guevara Reston Publication Co., Inc.,A Prentice-Hall Company Reston, Virginia

3. Construction Planning, Equipment and Methods by Robert L. Peurifoy, William B. Ledbetter, Clifford J. Schexnayder, McGraw-Hill Book Company, New Delhi.C

ENVIRONMENTAL ENGINEERING III
CE-705

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand the significance of air pollution and its impact identification
2. analyze and solve problems of air pollutants dispersion
3. design solutions for air pollution control devices
4. identify, formulate, and analyse problems related to solid waste and its management
5. analyze the impacts of projects on environment and its management plan

SYLLABUS

Unit-I: Air pollution

Meteorology, plume rise, plume behavior, dispersion of pollutants, factors affecting dispersion, Gaussian dispersion model, assumptions, applications and limitations.

Unit-II: Introduction to air pollution control devices

Particulate and gaseous contaminants, constructional features, working principle, design of control devices for particulate and gaseous contaminants.

Unit-III: Solid wastes

Physical and chemical characteristics of solid waste, generation, collection and disposal of solid waste, land filling operations.

Unit-IV: Noise pollution

Definition, fundamental concepts, sources and effects of noise, measurement techniques, noise pollution control and current standards.

Unit-V: Introduction to environmental impact assessment

Objectives, attributes of EIA, different techniques of EIA, impact assessment and environmental management plan.

Textbooks

1. Environmental Pollution Control engineering by CS Rao, Published by Wiley Science
2. Air Pollution: Its Origin And Control by Wark Kenneth Jr. , Wayne T. Davis, Cecil F. Warner Printice Hall
3. Air Pollution Control Engineering, 2nd Edition by Neol De Nevers, Mc Graw Hill
4. Environmental Engineering, Howard S Peavy , Donald R Rowe , George Tchobanoglows, Published by Tata McGraw-Hill, New Delhi

References

1. Textbook Of Noise Pollution And Its Control by S.C. Bhatia, Atlantic Publisher
2. Introduction To Environmental Engineering And Science by Glibert M. Masters published By Dorling Kinderslay India

1. Environmental Impact Assessment by PR Trivedi, PHP Publisher

2. An Introduction to Ecology and Environmental Science by P.C. Prabhu, C. Udayasoorian, G. Balasubramanian by Abhijit Publications

TRANSPORTATION ENGINEERING II
CE-706

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. build concept in different means of public and private transportation, sustainability and design of public transit network .
2. understand basic concepts, analysis and design of railway track.
3. understand basic concepts, analysis and design of railway track geometrics, stations, yards, signaling and metro railway.
4. analyse and design aspects of airports, runway, taxiway and air traffic control.
5. understand basic concepts of water transportation and bridge engineering.

SYLLABUS

Unit-I:

Urban transportation problems, Transportation and urban growth, Mass transit system, Comparison of different transit modes, Transit and environment, Transit and urban sustainability, Route design and scheduling of transit system.

Unit-II:

Introduction of railways, Railway Track, gauge, Track components – Rail, rail fittings, fixtures, Sleepers and ballast requirements and specification per kilometer of track, Formation and cross-section details, drainage, track defects.

Unit-III:

Geometric design of track, Points and Crossing, Station and Yards, Level crossing, Signaling and control, Suburban Railways, Metro railways system, Modernization of railways, Underground Railways and Tunneling.

Unit-IV:

Aircraft Characteristics, airport planning, site selection and configuration, Obstruction and zoning, Runway and taxiway design, Basic runway length and corrections, geometric design elements, Visual aids – marking and lighting, air traffic control and aids, Airport capacity.

Unit-V:

Sea Port, Harbors, Types and selection of site, Break-waters, Jetties, Wharves. Navigation aids: Buoys and light houses, Inland water transportation.

Components and classification of bridges, site investigation, waterway design.

Textbook

1. Urban Mass Transportation Planning, A. Black, McGraw Hill.
2. Railway Engineering by Chandra and Agarwal, Oxford University Press.
3. Railway Engineering by Saxena and Arora, Dhanpat Rai Publications.
4. Air Transportation Planning and Design by Saxena, CBS Publisher.

References

1. Planning and Design of Airports by Horonjeff and McKelvey, McGraw Hill.

2. Dock and Harbour Engineering, Oza and Oza, Charotar Publisher.
3. Bridge Engineering, Ponnuswamy, Tata McGraw Hill.

SEMESTER-VIII

SYLLABUS FOR ELECTIVESEARTHQUAKE RESISTANT DESIGN
CE 801

L: 4 T: 0 P: 0 Cr: 4

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand the concept of strong seismic motion and dynamics of structure.
2. understand the effects and behaviour of structures under earthquake.
3. gain adequate knowledge on seismic terminology and lateral forces on structures
4. learn ductile detailing of RCC structures, earthquake resistant design of masonry buildings as well as retrofitting

SYLLABUS

Unit-I:

Strong motions and Dynamics of Structure:Strong motions, Introduction, Terminology of Strong Motion, Nature of Ground Motion: source effect, Path effect, site effect. Amplitude, peak ground acceleration, vertical acceleration, seismometer and other seismic instruments.

Dynamics of Structure, modelling of Structure, lumped mass approach, equation of Motion, mathematical and structural modelling, System of Multiple Degrees of Freedom, Responses Spectrum.

Unit-II:

Effects and Behavior of structures under Earthquake: Introduction, Natural time period of site and structure, Liquefaction of soil, Restoring force, Damping, Effects of Structural Irregularities (vertical, plan and mass). Seismoresistant Building Architecture, Building Characteristics. Introduction of IS 1893:2002, Design Philosophy, Use of IS 1893:2002 and Determination of Design Lateral Forces: Equivalent Static Lateral force Method.

Unit-III:

Determination of Lateral Forces: Use of IS 1893:2002, Determination of Design Lateral Forces: Response Spectrum Method, Time History Method.(eigen values and eigen vectors, modal participation factors, modal mass, Use of ABS, SRSS, CQC methods)

Unit-IV:

Ductile detailing of RCC Structures, Earthquake Resistant Design of Masonry Buildings and Retrofitting: Ductility Considerations: Introduction, Assessment of Ductility, Factors Affecting Ductility, Ductility Factors, Ductile Detailing as per Use of IS 13920: 1993, Load transfer mechanism of joints

Earthquake Resistant Design of Masonry Buildings and Retrofitting: Behavior of masonry building under earthquake, lateral Load Analysis of Masonry Buildings. Design of brick masonry wall under vertical and laterals loads, concepts of Repair, Restoration and Strengthening of existing buildings, Methods of Retrofitting

Textbook

1. Earthquake Resistant Design of Structures by Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.
2. Elements of Structural Dynamics by Glen V. Berg, Prentice Hall Englewood Cliffs, New Jersey
3. Dynamics of Structures by Anil K. Chopra, Pearson Education
4. Geotechnical Earthquake Engineering by Steven L. Kramer, Pearson Education

WATER RESOURCES ENGINEERING
CE 802

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

1. Apply the concept of sustainable development to the management of water resources projects
2. Analyze water resource systems using linear and dynamic programming, and conduct financial analysis of projects
3. Analyze and design components of flood control infrastructure with environmental and societal considerations
4. Identify, formulate, analyze, and solve problems related to hydropower production
5. Apply appropriate techniques for the analysis and design of complex river training works

SYLLABUS

Uni-I:
Water resources of India, global water resources, surface and ground water resources, multipurpose uses of water purposes served by water resources development projects, impact of climate change on water resources, single and multipurpose projects, consumptive, non-consumptive, and partial consumptive use, firm yield, secondary yield, estimation of reservoir yield and storage capacity of reservoirs

Unit-II:
Sediment transport: Mechanism of sediment transport, sediment load, bed load, suspended load, reservoir sedimentation, trap efficiency, capacity-inflow ratio, measures for control of reservoir sedimentation, estimation of useful life of reservoir

Unit-III :
Floods and their management, Probable maximum flood, standard project flood, flood estimation techniques, classification of methods of flood control, flood plain management, flood damages, methods for estimation of flood damages, national policy on flood control

Unit-IV:
General arrangement of hydroelectric projects, hydropower development of India and the world, major hydroelectric projects in India, comparison with thermal and nuclear plants, issues related to hydropower production, firm and secondary power, power duration curves, reliability of hydropower production, illustrative examples

Unit-V:
River morphology; classification of rivers and river training works, methods of river training works, marginal embankments, guide bunds, groynes, cutoffs, bank pitching and launching aprons, design of guide bunds.

Textbooks:

1. Water Resources Engineering, R. K. Linsley et al.
2. Water Resources Engineering, Larry W Mays
3. Water Resources Engineering, S K Garg
4. Water Resources Engineering, P. N. Modi

References

1. Water Resources Engineering, Ralph A. Wurbs, Wesley P. James, Prentice Hall

2. Applied Hydrology, V. T. Chow et al.
3. Water Resources Systems Planning and Management“,Chaturvedi, M.C. Tata McGraw HillPub. Co., N Delhi
4. Water Resources Systems“,Hall. W.A. and Dracup, Tata McGraw Hill Pub. N Delhi

GROUND WATER ENGINEERING
CE803

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, a student should be able to:

1. learn different terminologies related with groundwater hydrology.
2. learn techniques of groundwater balance.
3. understand the principle and design of rain water harvesting structures.
4. understand the techniques of drilling techniques.

SYLLABUS

Unit-1:

Hydrologic Cycle , Concept of Groundwater in Hydrologic Cycle, Sub Surface Strata Analysis as Aquiclude, Aquitord , aquifuge and Aquifers Explanation of Unconfined, semi –confined and Confined Aquifers, Perched Aquifers. Geophysical methods for Groundwater Exploration , Resistivity System, Application of Schlumberger and Wenner’s configurations.

Unit-II:

Groundwater Balance Study. Concept of Gross Recharge, Recoverable recharge , Draft and Status of Groundwater Analysis using NABARD’s Norms and Local Norms . Numerical problems on Groundwater balance Equation and Status of Groundwater Stage of development. Analysis of Categories of Groundwater as White Category,Grey and Black Category.

Unit-III:

Principle and Definition of Rainwater Harvesting. Classification and Determination of Rainwater Harvesting. Numerical Problems on Rainwater Harvesting. Feasibility and Design of Rainwater Harvesting. Case Study on Rainwater Harvesting.

Unit–IV:

Introduction of Drilling techniques. Drilling in Alluvium and Soft Rock area, Reverse Rotary Drilling and Direct Rotary drilling methods,Calayx method, Driiling in Hard Rock area, DTH method and Woodex Method, Percussion Drilling. Geophysical Logging and Tube well design.

Reference

1. Groundwater Hydrology: Devid Keith Todd,
2. Hydrogeology : K.R. Karanth
3. Groundwater : H. M. Ragunath

CONSTRUCTION PROJECT MANAGEMENT
CE-804

L: 4 T: 0 P: 0 Cr: 4

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand basic concepts of project management, project organization, and estimate project cost for the client
2. use construction planning and application of computers in scheduling and resource leveling
3. evaluate project cost and bidding strategy and management of resources.
4. apply basic concepts of project cost and risk in construction and project monitoring

SYLLABUS

Unit-I:

Basic concepts of project management, project organization, client's estimation of project cost, construction contract

Unit-II :

Construction planning: Ladder network, precedence network, the line of balance, network technique advantages, Project scheduling and resource levelling, network crashing and cost-time trade-off. Computer applications in scheduling and resource levelling.

Unit-III:

Contractor's estimation of cost and bidding strategy, Construction equipment management, Construction material management.

Unit-IV:

Project cost and value management, risk in construction, Project monitoring and control system. Computer applications in Monitoring and reporting, construction quality management, construction safety management

Textbooks

1. Construction Project Management, Theory and Practice by Kumar NeerajJha, Pearson Education, New Delhi.
2. Scheduling Construction Projects by Sanra Christian Weber, Pearson Education, New Delhi.

References

1. Peter Fewings, "Construction Project Management", Taylor and Francis,U.K.
2. Peurifoy, R.L., Ledbetter, W.B.andSchexnayder, C., " Construction Planning,Equipment and Methods ", 5th Edition, McGraw Hill, Singapore, 1995.
3. Sharma S.C. " Construction Equipment and Management ", Khanna Publishers New Delhi, 1988.
4. Deodhar, S.V. " Construction Equipment and Job Planning ", Khanna Publishers, New Delhi, 1988.
5. Dr. Mahesh Varma, " Construction Equipment and its Planning and Application ",Metro-politan Book Company, New Delhi-, 1983.
6. Prasanna Chandra, " Pojects-Planning Analysis Selection Implementation & Review Fourth Edition ",Tata Mc Graw Hill Publishing Co., Ltd., New Delhi., 1995.
7. Joy.P.K.,, " Total Project Management - The Indian Context (Chapters 3- 7) ", New Delhi ,Macmillan India Ltd., 1992.
8. United Nations Industrial Development Organisation (UNIDO) " Manual for the preparation of Industrial Feasibility Studies ", (IDBI Reproduction) Bombay, 1987.

ARCHITECTURE AND TOWN PLANNING
CE805

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand the brief history and basic principle of architecture.
2. understand basic architectural design.
3. apply the basic concepts of town planning.
4. implement the concept of land use and town planning.
5. understand master plan and its implications.

SYLLABUS

Unit-I:
Brief history of Architecture, Egyptian, Greek, Roman and Indian architecture. Evolution of various structural forms. Impact of materials on building forms and construction techniques.

Unit-II:
Philosophy of architectural design: scale, form, texture, balance, skyline, unity, harmony, contrast, proportion. Colour in architecture, site selection and orientation of residential buildings.

Unit-III:
Evolution of human settlements: Factors and Forces. Utopian concepts of city planning: garden city, vertical city, broad acre city, linear city, Super Block and neighbourhood unit concepts.

Unit-IV:
Concepts for spatial arrangement of land uses: concentric zone, sector and multiplenuclei concepts, and their applicability to Indian conditions Density in residential and non-residential areas. Land use classification system. Surveys for town planning.

Unit-V:
Master plans; case studies: one for a new town plan and one for master plan of an existing city. Zoning and sub-division regulations and building byelaws. Agencies for implementation of master plans. Public participation. Problem of slums. Approaches for environmental improvement of slums.

Textbooks

1. A history of Architecture by Sir Banister Flechure.
2. A General History of Architecture by Bruce All Sopp.
3. Architecture by John Gloag.
4. The principles of Architecture Composition by Howard Robertson.
5. Indian Architecture by Percy Brown.
6. The Urban Pattern. City Planning and Design by Arthur B. Galion and Simon Eisner.

SYLLABUS

Master of Technology (M.Tech)

(Environmental Science & Engineering)

Department of Civil Engineering

Faculty of Engineering & Technology

Jamia Millia Islamia

New Delhi – 110025 (India)

http://www.jmi.ac.in/

January 2013

Preface

The revision and modification of the syllabus is a continuous process. The department was established in 1985 and a workshop of prominent engineers and educational list was held to develop the curriculum for the B-Tech in Civil engineering. The syllabus was later modified and published in the printed form in 1993. Since then a number of revisions have taken place both in the course structure and course content keeping in view the current trends in civil engineering education and demands of the industry.

The latest version of the syllabus is the outcome of a thorough revision of course structure and course content with inputs from subject experts and professionals. The syllabus has been designed to provide a solid foundation in the core areas of Civil engineering namely; structural engineering, geo-technical engineering, environmental engineering, water resources engineering, civil engineering materials, transportation engineering, surveying and GIS and construction management keeping in view the latest developments in these subject areas.

I wish to acknowledge the hard work put in by the faculty members in the updating and revision of syllabus. I also wish to convey my sincere thanks to the subject experts who gave their valuable inputs in finalizing this syllabus.

Professor Mohammad Shakeel

Head

About the University

Jamia Millia Islamia, an institution originally established at Aligarh in United Provinces, India in 1920 became a Central University by an act of the Indian Parliament in 1988. In Urdu language, Jamia means 'University', and Millia means 'National'.

The story of its growth from a small institution in the pre-independence India to a central university located in New Delhi—offering integrated education from nursery to research in specialized areas—is a saga of dedication, conviction and vision of a people who worked against all odds and saw it growing step by step. They "built up the Jamia Millia stone by stone and sacrifice by sacrifice," said Sarojini Naidu, the nightingale of India.

Under the colonial British rule, two dominant trends joined hands and contributed towards in the birth of Jamia. One was the anti-colonial Islamic activism and the other was the pro-independence aspiration of the politically radical section of western educated Indian Muslim intelligentsia. In the political climate of 1920, the two trends gravitated together with Mahatma Gandhi as a catalyst. The anti-colonial activism signified by the Khilafat and the pro-independence aspirations symbolised by the non-cooperation movement of the Indian National Congress helped to harness creative energies and the subsequent making of Jamia Millia Islamia. Rabindranath Tagore called it "one of the most progressive educational institutions of India".

Responding to Gandhiji's call to boycott all educational institutions supported or run by the colonial regime, a group of nationalist teachers and students quit Aligarh Muslim University, protesting against its pro-British inclinations. The prominent members of this movement were MaulanaMehmud Hasan, Maulana Mohamed Ali, Hakim Ajmal Khan, Dr. Mukhtar Ahmad Ansari, and Abdul Majid Khwaja. Hakim Ajmal Khan, Dr. Mukhtar Ahmed Ansari and Abdul MajeedKhwaja supported by Gandhiji shifted Jamia from Aligarh to Karol Bagh, in New Delhi in 1925. In 1925, after long deliberation, a group of three friends studying in Germany—Dr. Zakir Husain, Dr. Abid Husain and Dr. Mohammad Mujeeb—decided to serve Jamia.

One of the first steps they took was the introduction of the hugely popular evening classes for adult education. This movement was later to become, in October 1938, an institution called Idara-i-Taleem-o-Taraqqi.

In 1928 Hakim Ajmal Khan passed away. That was the beginning of the second financial crisis, as it was Hakim Sahib himself who had been meeting most of Jamia's financial needs. The leadership of Jamia then moved into the hands of Dr. Zakir Husain, who became its Vice Chancellor in 1928. To resolve Jamia of these frequent crises, a group of young Jamia teachers, led by Dr. Zakir Husain, took a pledge to serve Jamia for the next twenty years on a salary not more than Rs. 150. This group was called the Life Members of Jamia. (History repeated in 1942 when a second group of Jamia teachers took a similar pledge).

Jamia's department of Printing and Publications was trifurcated in 1928 with the newly established Jamia Press at Darya Ganj, Urdu Academy, and Maktaba Jamia under the charge of Prof. Mohammad Mujeeb, Dr. Abid Husain and Mr. Hamid Ali respectively.

On 1 March 1935, the foundation stone for a school building was laid at Okhla, then a non-descript village in the southern outskirts of Delhi. In 1936, all institutions of Jamia, except Jamia Press, the Maktaba and the library, were shifted to the new campus. The basic emphasis of Jamia was on evolving innovative education methods. This led to the establishment of a teacher's college (Ustadonka Madrasa) in 1938.

The fame of Jamia as an innovative education movement spread and dignitaries from foreign countries began visiting Jamia. Husein Raouf Bey (1933), Dr. Behadjet Wahbi of Cairo (1934), Ms. Halide Edib of Turkey (1936) were some of them. Foreigners, impressed by Jamia, began working in Jamia. The German lady Ms. Gerda Philips born (popularly known as AapaJaan) served Jamia for many years is buried in Jamia.

In 1939, Maulana Ubaidullah Sindhi (1872-1944), a theologian and freedom fighter, came to stay in Jamia on the invitation of Dr. Zakir Husain. He started a school of Islamic Studies in Jamia, called BaitulHikmal, propagating the ideology of Shah Waliullah. Zakir Husain, later the President of India, recalled those days of indestructible optimism in the face of depravity 'when they had a longing to build and nothing to build with, as "days of joy".

After the attainment of Independence, Jamia continued to grow as an academic institution with a difference. Many foreign dignitaries made it a point to visit Jamia Millia Islamia during their visits to New Delhi. Among those who visited Jamia include Marshal Tito (1954), king Zahir Shah of Afghanistan (1955), crown prince

Faisal of Saudi Arabia, king Reza Shah Pehlavi of Iran (1956) and prince MukarramJah (1960).

In 1962, the University Grants Commission declared the Jamia a 'deemed to be University'. Soon thereafter, the School of Social Work was established in 1967. In 1971, Jamia started the Zakir Husain Institute of Islamic Studies, to honour Dr. ZakirHusain, who had passed away in 1969. BE course in Civil Engineering commenced in 1978; in 1981, the faculties of Humanities and Languages, Natural Sciences, Social Science, and the State Resource Centre were founded. In 1983, it started the Mass Communication Research Centre and the Centre for Coaching and Career Planning. In 1985, it established the Faculty of Engineering & Technology and the University Computer Centre. Academic Staff College and the Academy of Third World Studies followed in 1987 and 1988.

By a Special Act of the Parliament, Jamia Millia Islamia was made a central university of India in December 1988.

At present Jamia has Nine faculties and a number of centres of learning and research, like AJK-Mass Communication Research Centre (MCRC), Academy of International Studies etc. The Jamia is also marching ahead in the field of Information Technology (IT). It offers various undergraduate and postgraduate IT courses. Apart from this, the Jamia has a campus wide network which connects a large number of its departments and offices.

About the Department

The Department of Civil Engineering is one of the oldest and the largest department in the Faculty of Engineering & Technology. The department has produced several eminent engineers who have made important contributions in the planning and execution of many important Civil Engineering projects in India as well as abroad.

The Department offers two undergraduate courses in Civil Engineering. The Department also offers Master's programme with specializations in Environmental Engineering and Earthquake Engineering .In all, there are around 560 students in undergraduate programme and 75 students pursuing their Masters degree. These courses are supported with strong doctoral programmes in all the major specializations of Civil Engineering. More than 45 Ph. D. research scholars including many from foreign countries are currently working in the department on emerging research areas.

The Department is known for its reputed faculty with expertise in diverse fields. Presently, the department has 23 highly qualified, experienced, sincere and dedicated teaching faculty members, actively participating in research and consultancy work. During last 5 years, faculty members have published more than 280 papers in reputed refereed International Journals.

Over a period of time, the Department has built up a wide research potential. The research programmes of the department are funded by various agencies such as Ministry of Human Resource Development (MHRD), Department of Science & Technology (DST), Ministry of Environment & Forests (MoEF), Central Pollution Control Board (CPCB), All India Council of Technical Education (AICTE), University Grants Commission (UGC), Ministry of Steel and Ministry of Urban Development. Major area of research in the Department include; Sustainable Development, low cost sanitation, water treatment, air, noise and water quality modelling, Reuse of concrete, application of GIS and remote sensing in water resources and environment, Vulnerability assessment, Seismic analysis of structures, retrofitting, Soil structure interaction, Hydro-climatology, Water resource assessment and management.

The Department has established a state of the art experimental facilities and laboratories in different fields of Civil Engineering. It has received the prestigious funding under FIST from DST and SAP from UGC. The Department has mobilized

more than Rs 250 millions from various external agencies to carry out research in cutting edge technologies in different fields of Civil Engineering.

The faculty also renders technical advice on live engineering problems to various Government and Private Sector companies throughout the country. These live projects are effectively used as training desk for our students at undergraduate and postgraduate levels. RITES, Military Engineering Services, Municipal Corporations of Delhi, Faridabad, Gurgaon, Gaziabad, NOIDA, PWD, CPWD, DDA, HUDA, Jal Nigam etc. regularly hire services for technical advice and vetting of designs of infrastructure projects. The Department has generated around Rs 800 million through consultancies during the last five years.

International and national conferences, seminars and special lectures are a regular feature of the Department to impart education and training. The Department has active collaboration with academics and industry such as University of Applied Sciences Erfurt (Germany), Wessex Institute (UK), University of Waterloo (Canada), Asian Institute of Technology (Bangkok) and Steel Authority of India (INDIA).

Leading MNCs and public sectors are regular recruiter of our students and many students have been selected in Engineering Services. Several of our alumni pursued higher education in USA, UK, Germany, Canada, Australia and France and have been appointed as faculty members and consultants abroad.

The Department strongly believes in continuous efforts to strive for excellence by exploring new frontiers of knowledge, imparting the latest technical knowledge to the students and conducting high quality research.

About the Program

The department of civil engineering is one of the oldest and the largest department in the faculty of engineering &technology. Currently the department is offering a master degree program in environmental sciences and engineering (part time course) among other three master programs. The department of civil engineering has five specialized faculty in environmental engineering discipline.

The faculty of environmental engineering group involves in the academic, research, planning, analysis and consultancy for designing of various municipal and industrial wastewater treatment facilities. The primary focus of the faculty of environmental engineering group is mainly on extending the knowledge to students on basic concepts and principles of environmental science and applied to solve major environmental issues related to pollution control. The program provides excellent technical knowledge in the area of environmental engineering that deals with the design of municipal/industrial wastewater treatment facilities as well as air and noise pollution control systems.

The ultimate goal of the master's program is to provide advance learning with enhanced analytical ability to solve problems that are interdisciplinary in nature and help in protecting the environment. Graduates of environmental engineering would have a wide variety of employment opportunities in both the private and public sectors.

The curriculum was updated regularly from time to time as per the recommendations of the board of studies in order to keep pace with the latest developments in related area.

The department has been planning to modernize with state of art facilities to be utilized for research and consultancy in addition to training the students.

Program Educational Objectives

The **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)** are the statements that describe the expected achievements from the programme. They are guided by global and local needs, the vision of the department, long term goals etc. The Programme Educational Objectives of M.Tech (Environmental Sciences and Engineering) includes:

1. To train and equip graduates with professional skills for successful careers dealing with analysis, design and management of projects related to water sector, air/ climate and global issues at national and international level.
2. To develop the competency in the area of environmental engineering so as to formulate, analyze and solve problems using the principles of science and engineering in related field.
3. To provide the students with a comprehensive and balanced understanding of the basics of science and environmental engineering.
4. To inculcate students maintaining high ethical standards, effective oral & written communication skills, work as part of team on multidisciplinary projects in diverse professional environment.
5. To provide student with an academic excellence, leadership as well as team work management skills and the life-long learning required for a successful professional career.

Program Outcomes

The curriculum and syllabus for M.Tech (Environmental Sciences and Engineering) program conform to result oriented teaching learning process. The curriculum and syllabus have been structured to meet one or more problem outcomes (POs).

Program outcomes are statements that describe significant and essential learning that students have achieved, and can reliably demonstrate at the end of a course or program. Program outcomes identify what students *will know and be able to do* by the end of a course or program – the essential and enduring knowledge, abilities (skills) and attitudes (values, dispositions) that constitute the integrated learning needed by a graduate of a course or program.

Graduates of the environmental engineering program will be able to:

1. Apply the knowledge of science and engineering and fundamental principles of basic biology to solve various problems related to environmental engineering discipline.
2. Conduct experimental research, analyze the data and interpret the results in the form of conceptual report and format it into a document in the form of thesis, professional report.
3. Follows the standard codes, specifications and IS codes to arrive on some consensus within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Learn basic techno-economic and techno-legal aspects of engineering projects, and preliminary aspects of project management and to work in a multidisciplinary environment.
5. Use current techniques, skills, and modern engineering tools/ software etc. necessary for computing and engineering practice.
6. Develop appropriate skills of written, oral and visual communications and make effective documentations and presentations.
7. Recognise and develop confidence for self education and ability to engage in continuing professional development.
8. Analyze the local and global impact of contemporary engineering issues on individuals, organizations and society.
9. Demonstrate their role as managers or entrepreneurs and contribute their skills to the society.
10. Recognize the importance of environmental engineering professional development by pursuing higher studies and research or face competitive examinations that offer challenging and rewarding careers.

FIRST SEMESTER

Course No.	Course Title	Credit	Period per week			Marks		
			L	T	P	Sessional	Final	Practical
EM 511	Environmental Chemistry & Microbiology	4	3	1	--	40	60	-
EM 512	Treatment Process I	4	3	1	--	40	60	-
EM 513	Environmental Lab	2	-	-	4	-	20	30
Total		**10**	**6**	**2**	**4**	**80**	**140**	**30**
Total credit = 10			**Total Periods Per week = 12**			**Total Marks=250**		

SECOND SEMESTER

Course No.	Course Title	Credit	Period per week			Marks		
			L	T	P	Sessional	Final	Practical
EM 521	Solid Waste Management	4	3	1	--	40	60	--
EM 522	Urban Environmental Utility Design	4	3	1	--	40	60	--
EM 523	Treatment Process II	4	3	1	--	40	60	--
Total		**12**	**9**	**3**	**0**	**120**	**180**	**0**
Total credit = 12			**Total Periods Per week = 12**			**Total Marks= 300**		

Sum credit First and Second semester (10 + 12) = 22

THIRD SEMESTER

Course No.	Course Title	Credit	Period per week			Marks		
			L	T	P	Sessional	Final	Practical
EM 631	Ecosystem & Watershed	4	3	1	-	40	60	-
EM 632	Air Pollution	4	3	1	-	40	60	-
EM 633	Industrial Effluent Treatment & Control	4	3	1	-	40	60	-
Total		**12**	**9**	**3**	**0**	**120**	**180**	**0**
Total credit = 12			**Total Periods Per week = 12**			**Total Marks= 300**		

FOURTH SEMESTER

Course No.	Course Title	Credit	Period per week			Marks		
			L	T	P	Sessional	Final	Practical
EM641	Air and Noise Pollution Control Systems	4	3	1	-	40	60	-
EM642	Experimental Design & Data Analysis	4	3	1	-	40	60	-
EM643	Environmental Impact Assessment	4	3	1	-	40	60	-
Total		**12**	**9**	**3**	**0**	**120**	**180**	**0**
Total credit = 12			**Total Periods Per week = 12**			**Total Marks= 300**		

Sum credit Third & Fourth semester (12 + 12) = 24

FIFTH SEMESTER

Course No.	Course Title	Credit	Period per week			Marks		
			L	T	P	Sessional	Final	Practical
	Elective I	4	3	1	-	40	60	-
	Elective II	4	3	1	-	40	60	-
EM 761	*Educational Tour/ Seminar	2	-	-	-	30	20	-
EM 751A	Project part I	6	3	1	-	90	60	-
Total		**16**	**9**	**3**	**0**	**200**	**200**	**0**
Total credit = 16			**Total Periods Per week = 12**			**Total Marks= 400**		

SIXTH SEMESTER

Course No.	Course Title	Credit	Period per week			Marks		
			L	T	P	Sessional	Final	Practical
EM 751F	**Project Part II	12	-	-	6	-	120	180
Total		**12**	**0**	**0**	**6**	**0**	**120**	**180**
Total credit = 12			**Total Periods Per week = 6**			**Total Marks= 300**		

Sum credit Fifth and Sixth semester (16 + 12) = 28

- ***Marks based on participation in the tour and submission of report**
- ****Marks based on final presentation (External Examiner)**

Project Part-I (Project) is meant for formulation of problem and literature survey

Project Part-II (Dissertation) is meant for experimental /field work, analysis of data and final presentation

Total Credit = 22+24+28 = 74

List of Electives

Course No.	Course Title
EM-7EL1	Disaster Management
EM-7EL4	Remote Sensing & GIS in Environmental. System
EM-7EL2	Design of Water Retaining Structures
EM-7EL5	Ground Water Management
EM-7EL3	Optimization Techniques
EM-7EL6	Surface Water Hydrology

FIRST SEMESTER

ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY

Paper Code	**EM - 511**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Provide understanding of basic concepts of water chemistry, chemical reactions and contaminants in water and wastewater
- Application of chemical reactions, equilibria and mass balance in water & wastewater treatment processes
- Basic understanding of microbiology involved in the biological treatment of wastewater

Course Learning Outcome

- Students have sufficient knowledge in the application of chemical reactions and mass balance in wastewater treatment
- Expected to apply reaction/rate kinetics to water and wastewater treatment processes
- Expected to understand taxonomy and apply microbiological reaction kinetics involved in biological treatment of wastewater

Course Description

Water Chemistry

Unit 1

Introduction - Role of chemistry in public health and in the control of pollution; water and wastewater pollution, industrial and hazardous wastes, air pollution; Basic concepts of general chemistry – oxidation–reduction reactions, gas laws, chemical equations, equilibrium; Alkalinity, Nitrogen & Phosphorous, Residual chlorine and chlorine Demand; DO, BOD, COD and TOC relationships

Unit 2

Fundamental of process kinetics – Types of chemical reactions, chemical kinetics i.e. reaction rates, kinetics of organic matter i.e. nature of BOD reaction; Material balance and reactor configuration; Solubility concept; Precipitation, sedimentation and adsorption mechanisms; Fate of organics - detergents and pesticides

Environmental Microbiology

Unit 3

Introduction - Taxonomy and Phylogeny - classification of microorganisms, aerobic and anaerobic bacteria; Infectious diseases - epidemiology of infectious diseases, water and air borne pathogens and their life cycle

Unit 4

Microorganisms - habitat requirements and population dynamics; Microbiology of purification processes – microbes of suspended growth and attached growth systems, methane forming organisms, anammox, microbes in water and waste water, soil and atmosphere

Unit 5

Microorganisms - detection techniques; Sampling strategies and monitoring network for surface water and ground water resources and distribution networks, pathogens-indicator of pollution; Molecular tools; Method of isolation

Text Books

- Chemistry of Environmental Sciences and Engineering, Sawyer and McCarty, Tata McGraw Hills Pvt. Ltd. New Delhi, India
- Process Chemical for Water and Wastewater Treatment, L.D. Benefield, Prentice Hall Inc. New Jersey, USA
- Microbiology for Environmental Engineering, Tata McGraw Hill Series

Reference Books

- Environmental Engineering, Gerard Kiely, The McGraw Hill Co. USA
- Introduction to Environmental Engineering and Science, Gilbert and Masters, Pearsons, Education
- Environmental Biotechnology, Rittmann and McCarty, Tata McGraw Hill Pvt. Ltd. India

TREATMENT PROCESS – I

Paper Code	**EM – 512**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Provide basic knowledge of water quality parameters and their standards
- Provide scientific understanding on water treatment operations and processes
- Provide hands on expertise to design independently water treatment systems

Course Learning Outcome

Expected to become a successful Environmental Engineers having capability to design independently water treatment systems

Course Description

Unit 1

Introduction – water quality parameters, sources; Water intake (surface and subsurface), screening of water, different types and arrangements of screens, aeration – removal of dissolved gases, iron and manganese, Sedimentation theory, different types of settling and their applications

Unit 2

Coagulation and flocculation – basic concepts, various types of coagulants and their applications, design of flocculators; theory of filtration, types of filters - rapid and slow sand filters and dual filters, various types filter design

Unit 3

Water softening; chemical precipitation -ion balance; ion exchange - ion exchange principles, cation and anions exchangers, types of resins and their suitability

Unit 4

Disinfection - theory of disinfection, common disinfectants, suitability of disinfectants, chlorination – pre-chlorination, post chlorination, super-chlorination, de-chlorination, design of disinfection facilities

Unit 5

Advance water treatment techniques; membrane separation techniques – microfiltration, ultra-filtration, nanofiltration, reverse osmosis; adsorption - types of adsorbents, applications and limitations, adsorption isotherms

Text Books

- Environmental Engineering, Peavy and Row, Tata McGraw Hills Pvt. Ltd. New Delhi, India
- Water Supply, Steel and McGhee, McGraw Hill Publications
- Water Technology, Hammer and Hammer, Tata McGraw Hills Pvt. Ltd. New Delhi, India

Reference Books

- Environmental Engineering, Gerard Kiely, The McGraw Hill Co. USA
- Environmental Engineering, Sincero and Sincero, Tata McGraw Hills Pvt. Ltd. New Delhi, India
- Introduction to Environmental Engineering and Science, Gilbert and Masters, Pearsons, Education

Software or other Requirement

- EPANET, Water CAD

ENVIRONMENTAL LABORATORY

Paper Code	**EM - 513**	**(Lectures –Tutorial-Practical)/Week**	**(0-0-4)**
Credits	**2**	**Course Marks (Mid-End-Total)**	**(30-20-50)**

Course Objectives

- To provide learning on basic experimental techniques to analyze different water and wastewater samples
- To inculcate basic concepts for environmental quality monitoring, assessment and evaluation

Course Learning Outcome

- To enable students to quantify and assess different water and wastewater quality parameters
- Expected to plan an approach for monitoring the industrial and municipal wastewater treatment facility and different field-testing

Course Description

TITLE OF EXPERIMENTS

Water Quality Analysis

To carry out the experiments on determination of basic water quality parameters such as

(i) pH and Alkalinity
(ii) Turbidity and Optimum Coagulant Dose
(iii) Sulphate
(iv) Chloride
(v) Microbiological Water Quality Parameter – MPN Technique

Wastewater Characterization

To carry out the experiments on wastewater characterization for

(vi) TSS, TDS, Fixed and Volatile Solids
(vii) Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD)

(viii)	Chemical Oxygen Demand (COD) of given samples of water
(ix)	Phosphorous
(x)	Kjeldhal Nitrogen and Ammonia
(xi)	Determination of Coagulant Dose by Jar Test

Text Books

- Chemistry for Environmental Sciences and Engineering, Sawyer and McCarty, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Wastewater Treatment, Treatment and Reuse, Metcalf and Eddy, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Standard Methods for Examination of Water and Wastewater, AWWA, APHA, 21st edition, USA

Reference Books

- Process Chemistry for Water and Wastewater Treatment, L.D.Benefield, Prentice Hall Inc. New Jersey, USA

SECOND SEMESTER

SOLID WASTE MANAGEMENT

Paper Code	**EM – 521**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Provide basic knowledge of solid waste in terms of characteristics and composition
- Provide understanding of processes used for sustainable solid wastes disposal systems
- Develop skill to design the municipal solid waste management systems

Course Learning Outcome

Expected to become a competent Environmental Engineers having sufficient knowledge on design and application of solid waste management systems

Course Description

Unit 1

Definition and classification of different categories of solid wastes (municipal, industrial and biomedical), identification of sources of waste generation, method of inventory and auditing of sources. Physical, chemical and biological properties of wastes.

Unit 2

Characteristics of wastes, screening criteria, waste toxicity, flammability, corrosivity, reactivity, bio-accumulation, waste compatibility matrix, high toxic-low volume and low toxic industrial waste, mass balance.

Unit 3

Integrated wastes management system Waste minimization, process modification, cost benefit analysis of waste minimization, material and energy recovery, concept of waste exchange and balanced industrial complexing, Case Studies.

Unit 4

Collection and transportation of solid waste, collection equipments, systems of collection, garbage chutes, bailing and compacting, transfer station, design of wastes collection and transportation system, Route optimization

Unit 5

Disposal methods – landfills: site selection, design and operation of sanitary landfills, leachate and landfill gas measurement, incineration process, open dumping, ocean disposal, various methods of refuse processing, composting, pyrolysis, incinerators, compost plants etc. fertilizer, fuel and food values, design of incinerators, compost plants, legislation related to solid wastes management

Text Books

- Environmental Engineering, Peavy and Row, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Wastewater Treatment, Treatment and Reuse, Metcalf and Eddy, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Solid Waste management, Gorge Tchonobanoglous, Tata McGraw Hill Series

Reference Books

- Environmental Engineering by Sincero and Sincero, Tata McGraw Hill Series
- CPHEEO Manual on Municipal Solid Waste Management

URBAN ENVIRONMENTAL UTILITY DESIGN

Paper Code	**EM – 522**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Disseminate knowledge and skill for proper design of water supply, sewerage system, urban hydrology as well as rainwater harvesting.
- To inculcate the understanding on selection of location and engineering design of landfill sites for municipal solid waste.

Course Learning Outcome

- Trained and skilled environmental engineer having sufficient knowledge to plan and design water supply, sewerage, drainage, rainwater utility system.
- Skilled Engineer who can select and design engineering landfill site.

Course Description

Unit 1

Site selection criteria for secured land fill sites, estimation of area required for land fill sites, design of engineering land fill site, design of natural and artificial lining system, geo-liner, design of leachate collection system, design of gas recovery system.

Unit 2

Municipal water requirements, water supply appurtenances distribution systems, optimum design of water main, design of water distribution network, computer applications in water supply design,

Unit 3

Quantification of rain water- runoff, sewer appurtenances quantification and variation of municipal sewage, design of open and closed sewerage systems, computer application in design of sewerage system

Unit 4

Water conservation – principles and practices, rainwater harvesting system, different types of rainwater harvesting system(RWH), characteristics of good rainwater harvesting system, design parameters and design of RWH units.

Text Books

- Water Supply, Steel and McGhee, McGraw Hill Series
- Environmental Engineering by Peavy, McGraw Hill
- Introduction to Environmental Engineering, Davis and Cornwell, McGraw Hill Series

Reference Books

- Manual of Water Supply, CPHEEO, MoUD, Govt. of India
- Manual of Sewerage System, CPHEEO, MoUD, Govt. of India
- Manual of Solid Waste Management, CPHEEO, MoUD, Govt. of India

TREATMENT PROCESS – II

Paper Code	**EM – 523**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- To provide basic knowledge of wastewater characterization and their effluent discharge standards
- To provide scientific understanding on wastewater treatment operations and processes
- To provide hands on expertise to design independently wastewater treatment systems

Course Learning Outcome

- Environmental Engineers acquire the capability to design wastewater treatment systems
- The student will become well acquainted with basic design and operation of treatment plants for advanced physico-chemical-biological treatment of domestic wastewater with regard to carbon, nitrogen and phosphorous removal. It also gives an insight of natural and decentralized treatment system.

Course Description

Unit 1

Municipal wastewater – characteristics and composition; preliminary treatment systems - screening, grit removal and primary sedimentation – theory and design, flow measurement techniques.

Unit 2
Biological treatment process - aerobic and anaerobic treatment systems, basic fundamentals of aerobic and anaerobic treatment of wastewater, reaction kinetics
Unit 3
Biological treatment systems, suspended and attached growth systems, activated sludge process (ASP) and its modifications, aeration principle and mechanism, diffused and surface aerators,
Unit 4
Attached growth systems; trickling filter, types of trickling filters, reaction kinetics, efficiency calculations and design, bio-filters and rotating biological contactors – working principle and design
Unit 5
Low cost systems, stabilization ponds, lagoons, oxidation ditches, tertiary treatment system, recycling and resources recovery, sludge treatment.

Text Books

- Wastewater Treatment, Treatment and Reuse, Metcalf and Eddy, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Wastewater Technology, Hammer and Hammer, Tata McGraw Hill Pvt. Ltd. New Delhi India

Reference Books

- Process Chemistry for Water and Wastewater Treatment, L.D. Benefield, Prentice Hall Inc. New Jersey, USA
- Treatment Plant Design, S.R.Qasim, TA Publishing, USA
- Introduction to Environmental Engineering and Science, Masters, Tata McGraw-Hill

THIRD SEMESTER

ECOLOGY AND WATERSHED MANAGEMENT

Paper Code	**EM – 631**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Provide basic knowledge of ecological principles and ecosystem
- Impart basic knowledge of ecological principles and ecosystem for sustainable environmental development
- To introduce students with the concept of a watershed and its quantitative characteristics.
- To discuss various aspects of watershed development and management – in terms of technological, social. Ecological and environmental issues.

Course Learning Outcome

- Environmental Engineers having knowledge of ecological principles and ecosystem for sustainable environmental development as well as fully aware of principles and practices of water management approaches
- Upon successful completion of this course, student will be able to understand the basic concept of watershed development in context to its morphometric characteristics

Course Description

Ecology (EM631A)

Unit 1

Ecology – meaning and scope, ecosystem and its attributes, concepts of ecosystem, structure and function of ecosystem; Energy flow in ecosystem, Ecological succession

Unit 2
Ecological systems – Freshwater environment, marine system, terrestrial ecosystems; Equatorial, hot deserts, taiga, tundra and mountains ecosystems; Disruption of ecological systems, impact of man on environment, global environmental challenges and ecological policies

Watershed Management (EM631B)
Unit 3
Introduction: area of the basin, stream order, drainage density, stream density, length of the basin, shape of the basin, relief of the basin, slope of the basin.
Unit 4
Watershed characteristics: Schumm's hypothesis of basin area, basin shape and their expected hydrographs, slope of the basin by grid method, estimation of basin length, Hortons law of channel number and channel length, concept of channel slope based on Kennedy's theory, stream frequency.
Unit 5
Watershed classifications, based on the size and land use pattern, soil and water conservation, soil erosion, measures for erosion control, types of soil surveys

Text Books

- Environmental Engineering, Grady, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Ecology and Environment, S.D. Sharma, Chand Publications, Meerut, India
- Watershed Management by Murthy J. V. S., New Age International, New Delhi – 1998
- Watershed Hydrology, by Black Peter E., Prentice Hall, London - 1991

Reference Books

- Environmental Studies, EruchBarucha, University Press India
- Watershed Management and Sustainable Management by Gopal Iyer K. and Roy U. N., Kanishka Publishers, New Delhi 2005
- Integrated Watershed Management by Rajesh Rajora, Rawat Publication, New Delhi – 1998

AIR POLLUTION

Paper Code	**EM - 632**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- The course provides basic understanding of air pollution, sources, effects and dilution mechanism of pollutants.
- The prime objective of this course is to develop skills among the students to design industrial stacks, predict the pollutant concentrations and become well aware of air quality monitoring and with its instrumentations.

Course Learning Outcome

Environmental Engineers capable of designing industrial stacks, predict the pollutant concentrations and become well aware of air quality monitoring and with its instrumentations

Course Description

Unit 1

Introduction, definition of air pollutant, general nature of air pollution problem, effects of major pollutants on human, vegetation and other materials, global air pollution impact e.g. global warming, depletion of ozone layer, acid rain etc.

Unit 2

Meteorology, lapse rate, stability conditions, wind velocity profile, stack plumes, plume rise, calculation of plume rise, effective stack height

Unit 3

Dispersion of pollutant in the atmosphere, factors affecting the desperation phenomena, eddy diffusion model, Gaussian dispersion equation, reduction of

Gaussian dispersion equation to ground level C/L concentration and for line sources, assumptions and limitations

Unit 4

Air quality monitoring; sampling duration, selection of sampling sites, principle of sampling instruments, measurement units, sampling and analysis of SPM, RSPM, SOX , NOx, and CO

Unit 5

Indoor pollution; introduction, types of pollutants, sources, effects, indoor air quality modeling

Text Books

- Introduction to Air Pollution, Crawford, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Air Pollution, Neol De Nevers, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Environmental Engineering, Peavy and Rowe, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Introduction to Environmental Engineering, Masters & Masters, Printice Hall

Reference Books

- Fundamentals of Air Pollution, Daniel A. vallero, Science Direct Publication

INDUSTRIAL EFFLUENT TREATMENT & CONTROL

Paper Code	**EM - 633**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Provide basic knowledge of industrial operations and principal effluent generation units along with the effluent characterization
- Application of fundamental principles (learned in treatment process I and II) for the treatment of industrial wastewaters
- Disseminate knowledge of wastewater in river pollution and its modeling, disposal of effluent in sea and lakes

Course Learning Outcome

- Expected to become a successful Environmental Engineers having capability to design independently industrial effluent treatment systems
- The student will become well acquainted with basic design and operation of treatment plants for industrial effluent
- Students are expected to understand the river pollution and its control and management.

Course Description

Unit 1

Characteristics and composition of different industrial waste, sampling, preservations and analysis techniques Standards for waste disposal, General methods of treatment of industrial effluent. Nutrient and its role in the treatment.

Unit 2

Pre Treatment of effluent waste volume and strength reduction, equalization and proportioning of wastes. Neutralization of wastes, oil removal and floatation.

Unit 3
Sources of Effluent generation, its characteristics, and treatment scheme for high strength organic effluent industries, such as textiles, dairy, sugar, brewery, distillery pulp and paper etc.

Unit 4
Sources of Effluent generation, its characteristics, and treatment scheme for chemical industries, such as fertilizer, tanning, iron and steel, metal finishing and thermal power plant.

Unit 5
Disposal of waste in streams and estuaries, self-purification in stream, physical, chemical and biological forces of self-purification, stream constants, oxygen balance in streams, stream surveys and investigation.

Text Books

- Industrial Pollution Control, Numero Nelson, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Wastewater Treatment, Treatment and Reuse, Metcalf and Eddy, Tata McGraw Hill Pvt. Ltd. New Delhi India

Reference Books

- Industrial Pollution Control, Eckenfelder, Tata McGraw Hill Series
- Wastewater Treatment by M.N. Rao and A.K.Datta, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
- Design of municipal Wastewater Treatment Plants, WEF Manual of Practice No. 8, Vol.1, McGraw Hill Series, New York

FOURTH SEMESTER

AIR & NOISE POLLUTION CONTROL SYSTEMS

Paper Code	**EM – 641**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Provide students with an introduction to air pollution control devices-constructional features and working principles
- Understanding of technical aspects of regulating and controlling air pollution
- Trained the students to design the control equipment independently
- Familiarize the students to basic concept of noise pollution and its control

Course Learning Outcome

- Expected to become a successful Environmental Engineers having capability to design independently air pollution control systems
- The student will become well acquainted with basic design and operation of air pollution control systems

Course Description

Unit 1

Introduction, gaseous pollutants control devices and their working principle, absorption, adsorption, combustion and condensation, SOx control and NOx control, process control, in combustion process and treatment of flue gases, catalytic converters.

Unit 2

Introduction, particulate control equipments; gravity settling chambers, cyclone separators, fabric filters, electrostatic precipitators and wet scrubber, working principle, design, advantage, and disadvantages and limitations of equipments. Design of ventilation system, basics of hood and duct design.

Unit 3

Noise pollution, different types of noise sources, noise standards, noise propagation, inverse square law, noise measurements, addition and subtraction of noise levels, noise rating system, effects of noise on hearing, working performance, damage-risk - criteria, annoyance, speech interface

Unit 4

Noise prediction modeling, various type of models and input parameter required, application, advantages, disadvantage and limitations of noise prediction models, Noise control - control at source, during transmission and at receptor end, noise barriers and their design.

Text Books

- Air Pollution and Control, Crawford, McGraw Hill Series
- Environmental Engineering, Peavy and Rowe, McGraw Hill Series

Reference Books

Fundamentals of Air Pollution (Fourth Edition), Daniel A. Vallero, Science Direct

EXPERIMENTAL DESIGN AND DATA ANALYSIS

Paper Code	**EM – 642**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- The course is designed to acquaint students with the principles of experimental design, analysis of variance and regression and correlation analysis.
- The course includes basic statistical methods: computing descriptive statistics, hypothesis testing and analysis of variance along with graphical representation of data.
- The course aims at to develop the ability among the student to analyzed the environmental data and make it presentable form in a scientific manner.

Course Learning Outcome

- Environmental engineer becomes familiar with basic statistical methods: computing descriptive statistics, hypothesis testing and analysis of variance along with graphical representation of data.
- Environmental Engineers having ability to analyzed the experimental data and make it presentable form in a scientific manner.

Course Description

Unit 1

Survey and experiments, sources of error in experiments, minimization of error at source, requirements for good experiments, reduction of error, precision measurement and estimation choice of units, observations and treatments

Unit 2

Basic statistical concepts of data analysis; normal distribution, properties of Gaussian distribution, area under the normal distribution curve, standardised normal distribution,

confidence level, central limit theorem, significance test, chi- square test for goodness of fit, criteria for goodness of fit.

Unit 3

Graphical representation and curve fitting of data, equation of approximate curve, determination of parameters, linear relationships, least square equation of second degree and higher.

Unit 4

Introduction to environmental modeling, various modeling approaches, development of simple models, neural networks, basic concept of artificial neural network, application of artificial neural network on environmental modeling.

Text Books
• Statistical Methods, Nagpal, Tata McGraw Hill Series • Statistics Methods and Applications, Paul Lewicki and Thomas Hill, Tata McGraw Hill

Reference Books
• Introduction to Basics of Statistics, Gerhard Bohm, Desy Books,

Software or other Requirement
• Statistica • Statsoft • SPSS

ENVIRONMENTAL IMPACT ASSESSMENT AND AUDITING

Paper Code	**EM – 643**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- This course aims at providing a sufficient insight into the environmental impact assessment methodologies.
- The course includes topics related to description of environmental settings, prediction of impacts, evaluation of impacts & their mitigation plan.
- Regulatory requirements of EIA & procedure for obtaining environmental clearance from regulatory agencies also form integral part of course.

Course Learning Outcome

- Environmental engineer becomes familiar with insight into the environmental impact assessment methodologies, environmental settings, prediction of impacts, evaluation of impacts & their mitigation plan.
- Environmental Engineers acquire sufficient knowledge that helps to obtain environmental clearance from regulatory agencies

Course Description

Unit 1

Definition of environmental impact assessment and environmental auditing, objectives of EIA. Types of environmental impacts, various steps in EIA. Environmental legislations,

NEPA, environmental protection act 1986, other acts, organizational setup.

Unit 2

Description of Environment: Air, water, land, ecology, noise, human aspects, socio-economic aspects and resources, Definition of the attribute, Activities that affect the

attribute. Source of impacts, Variables to measure. Data sources, skill required, instruments.

Unit 3

Evaluation and interpretation of data, geographical and temporal limitations, mitigation of impact and temporal effects. Prediction of impacts on environmental parameters related to air, water, land, noise, flora &fauna, socio-economic, human health etc.

Unit 4

Impact assessment methodologies, selection of methodology, categorization of methodologies, review criteria, methodology descriptions, review and future directions, generalized approach for impact analysis.

Unit 5

Environmental attributes, institutional constraints, environmental setting and computer based system (introduction), procedure for developing IA, EIS and EA and its review.

Ministry of environmental guidelines, case studies on EIA/EIS and EA.

Text Books

- EIA, Canter, Tata McGraw Hill Pvt. Ltd. New Delhi India
- Essentials of Environmental Studies, Joseph and Nagendran, Pearson Education

Reference Books

- Environmental Impact Assessment: A Methodological Approach, Richard K. Morgan, Springer Science Publication
- Environmental Impact Assessment" Cambridge, Gilpin
- Introduction to Environmental Engineering and Science, Masters, Tata McGraw-Hill
- Environmental Assessment Sourcebook - The World Bank
- Environmental Management in Organizations – The IEMA Handbook, John Brady, Earthscan, London

FIFTH SEMESTER

(Elective Courses)

Disaster Mitigation for Sustainable Development

Paper Code	**EM7EL1**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- To provide knowledge to students about the natural disasters and mitigation
- To familiarize the students about the causes and consequences of natural disasters

Course Learning Outcome

- Providing sufficient knowledge onthe causes, consequences and mitigation efforts for different types of natural disasters - prevalent at national and international level
- Environmental Engineers should be able to understand about the approach to mitigate the natural disasters

Course Description

Unit 1

Disaster - definitions, concept and perceptions. Different types of disasters. Disaster and development. IDNDR / ISDR, Yokohama Strategy and Hyogo Framework of disaster mitigation and management. Disaster management policy – national and states. Disaster management act – national and states. Recent initiatives at national and state level.

Unit 2

Disaster management mechanism – national, state and district levels. Select global practices. Disaster management plans- various levels. Role of NGOs / CBOs and Armed Forces in disaster management. Community Based Disaster Preparedness (CBDP) – framework and formulation. Disaster education and awareness.

Unit 3

Natural Disasters - physical phenomenon, causes and consequences mitigation and management practices – cyclones, floods, earthquakes etc. Forecasting and early warning systems. Documentation and case studies on natural disasters. Importance of communication and information technology in disaster management

Unit 4

Disaster and environment. Natural resource management. Land use planning. Urban risk mitigation. Relationship between environmental pollutions, global warming, ozone layer depletion, climate change with disaster mitigation efforts. El-Nino and la-Nina effects and their impacts. Environmental consequences of disaster events

Text Books

- An Introduction to Sustainable Development, Peter P. Rogers, Tata McGraw Hill
- Disaster and Development, Andrew E. Collins, Tata McGraw Hill

Reference Books

- Disaster Management, A.L. Caressi, Routledge, taylor and Francis Publication

DESIGN OF WATER RETAINING STRUCTURE

Paper Code	**EM7EL2**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Providing basic knowledge of and skill for different types of reinforced cement concrete structures commonly used in water supply and sewerage system.
- To disseminate knowledge to students for design of water retaining structures

Course Learning Outcome

- Providing sufficient knowledge on application of various fundamental principles to design the water retaining structures
- Environmental Engineers should be able to understand about basics of designing the structures involved in water and wastewater

Course Description

Unit 1

Design and constructional aspects, durability requirement, provision of Indian standards and their applications;

Unit 2

Design of different water retaining structures, design of cantilever walls to retain liquids, IS 2911-1965,

Unit 3

Design of flat slab, roofs and columns for reservoirs, Circular and rectangular tanks, overhead tanks,

Unit 4

Underground and on-ground, pipes and conduits, IS 1893-2002.

Text Books
• Design of Reinforced Concrete, A.K. Jain, Khanna Publishers, India • Reinforced Concrete Construction for Water Retaining Structure, K.K. Meghashyam Jain Book Depot India

Reference Books
• Design of Water Retaining Structure, Batty, John Willey Publication

OPTIMISATION METHODS

Paper Code	**EM7EL3**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Provide basic knowledge of optimization as a powerful tool that can be systematically applied for obtaining efficient and cost-effective solutions to a wide variety of engineering problems.
- Introduce and apply commercially available as well as open source software to the solution of engineering optimization problems

Course Learning Outcome

- Providing sufficient knowledge on application of various application-oriented presentations of the fully array of traditional and recently developed optimization techniques being used by the engineers.
- Emphasis is laid on the application of optimization techniques to real-world problems from various areas of environmental engineering.
- Should have a sound knowledge of basic theoretical principles of optimization and to formulate optimization models.

Course Description

Unit 1

Introduction to optimization, historical development, engineering application of optimization, formulation of design problems as mathematical programming problems, classification of optimization problems, introduction to stochastic and deterministic algorithms.

Unit 2

Linear programming, graphical method, simplex method, duality in linear programming, post- optimality analysis, LP for multi period decision process,

application of LP to environmental engineering problems, use of spread sheets for solving LP problems.

Unit 3

Non-linear programming, Single variable and Multi variable unconstrained optimization techniques, direct search methods, descent methods, constrained optimization, multivariable optimization with equality and inequality constraints, direct and indirect methods, Kuhn- Tuker conditions for constrained optimization.

Unit 4

Dynamic programming, characteristics of dynamic programming problems, Computational procedure, Multi decision processes, Concept of sub optimization and the principle of optimality, Discrete differential dynamic programming, Application of environmental engineering problems.

Text Books

1. Hillier, F. S., and G. J. Lieberman, "Introduction to Operations Research", McGraw Hill, 2001
2. R.L. Fox, "Optimisation Methods for Engineering Design", Addison Wesley USA, 1971
3. G. Haddley, "Linear Programming", Reading, Mass., Addison-Wesley, 1962
4. Wayne L Winston, Operations Research: Applications and Algorithms, Cengage Learning; 4 edition, 2003

Reference Books

1. Deb, K. "Optimisation for Engineering Design", Prentice Hall of India, 2000.
2. S. S. Rao, "Optimisation Theory and Applications", Wiley Eastern, New Delhi, 1978.
3. Taha, Hamdy"Operations Research, Pearson, USA.
4. D. E. Goldberg, "Genetic Algorithm in Search, Optimisation and Machine Learning", Reading, Mass., Addison-Wesley, 1989

REMOTE SENSING AND GIS

Paper Code	**EM7EL4**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- To study the basic concepts and principles of remote sensing.
- To study various image enhancement and classification techniques.
- To study and understand basic principles of GIS

Course Learning Outcome

- The students will be able to know about different types of satellites products and their characteristics.
- They will be able to interpret and classify remote sensing data products
- They will be able to geo reference maps and images using different coordinate systems

Course Description

Unit I

Geographic coordinates- latitude and longitude; Survey of India toposheets, basic projections and coordinate systems.

Basic concept of remote sensing- energy sources and radiation principle, EMR and spectrum; EMR interaction with atmosphere and earth surface features- reflection, absorption, emission and transmission; spectral response pattern- vegetation, soil, water bodies; Characters of remote sensing system- platforms and sensors, orbits types, resolutions; Characters and applications of satellites- IRS series, LANDSAT series, SPOT series, high resolution satellites.

Unit II

Image geometric distortion- sources and causes of distortion, rectification- GCP, resampling, image registration/geo referencing; Image Enhancement- satellite image

statistics, basics of histogram; contrast stretching- spatial feature manipulations, spatial filtering, convolution low pass and high pass filters, edge detection; Image Classification- introduction, classification techniques, supervised-training stage, classification stage, parallelepiped classifier, Gaussian maximum Likelihood classifier, unsupervised classification.

Unit III

Introduction, definition of GIS, components of GIS, functions of GIS, spatial entity, spatial data model-raster and vector, data structure, attribute data- input and management, concept of Metadata; Process of GIS- data capture, data sources, GPS, data encoding methods, linking of spatial and attribute data;

Unit IV

Spatial data analysis- measurement of length, perimeter and area, queries, reclassification techniques, buffering and neighbourhood functions, spatial interpolation; overlay analysis-vector and raster overlay; surface analysis and interpolation-DEM, slope, aspect, watershed analysis; application of GIS in Civil Engineering.

Theoretical knowledge gained will be put into practice through hands-on laboratory exercises utilizing the software such as ERDAS IMAGINE and ArcGIS.

Text Books

- Remote Sensing and Image Interpretation by Lillesand and Kiefer, John Wiley & Sons, Inc.
- Principles of Geographic Information Systems by Burrough, P.A. and McDonnell R.A., Oxford: Clarendon Press.
- Remote Sensing and GIS byBasudebBhatta, Oxford University Press.

Reference Books

- Principle of Remote Sensing by Paul J. Curran, Longman, London and New York
- Remote Sensing Principles and Interpretation by Floyd F. Sabins, W H Freeman and Company

Software or other Requirement

- ERDAS IMAGINE
- ArcGIS

GROUND WATER MANAGEMENT

Paper Code	**EM7EL5**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Providing basic knowledge to students on groundwater resources and its role in sustainable development.
- Impart to students the basic concepts of ground water investigation, long term yield assessment and design of groundwater exploration.

Course Learning Outcome

Providing sufficient knowledge on application of concept of pollutant movement in saturated media and its remediation

Course Description

Unit 1

The concept of hydrologic cycle, ground water condition and behavior, basic parameters for groundwater characterization with time and space.

Unit 2

Groundwater investigation, groundwater investigation using indirect methods, numerical problems with field application.

Unit 3

Groundwater balance study, Scenario at a glance, universal budgeting of groundwater, analysis of ground balance study using water level fluctuation and specific field method, numerical problems. Concept of basin management, groundwater development case studies

Unit 4
Pollutant movement in ground water, dispersion, diffusion, remediation and natural attenuation

Text Books

- Groundwater Hydrology, D.K. Todd
- Hydrogeology, K.R.Karanth
- Groundwater Management Practices, CRC Press
- Groundwater Resources, www.google.books.com

Reference Books

- Urban Groundwater Management, Springer Publications

SURFACE WATER HYDROLOGY

Paper Code	**EM7EL6**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- Providing basic knowledge on study of hydrology is a pre-requisite for efficient design of water resource systems.
- Design of hydraulic structures such as dams, flood protection works, and irrigation facilities require hydrological information as essential input.
- Techniques for stream flow and velocity measurement form an important part of data collection procedures, and will be discussed in detail in this course.

Course Learning Outcome

- Providing sufficient knowledge on application of basic principles of hydrology on estimation of design flood and useful life of reservoirs.
- Practicing engineers would be able to work within the fields of either earth or environmental science, physical geography, and civil and environmental engineering

Course Description

Unit I

Precipitation: Hydrologic cycle, Types and Forms of precipitation, Adequacy of rain gauges, generation of rainfall data, depth- area duration analysis. Consistency in rainfall records. Average rainfall. Frequency analysis.

Loses from precipitation: Evaporation process, Transpiration, Evapotranspiration and Evaporation Control.

Unit II

Infiltration: Infiltration process, measurement of infiltration and infiltration indices.

Runoff: Factors affecting runoff, yield and its estimation, flow duration curve, and rainfall - runoff correlation.

Unit III

Steam flow measurement; measurement of stage and velocity, direct and indirect measurement of discharge, rating curves, stage discharge relationship.

Hydrograph; component parts of a hydrograph, base flow separation, unit hydrograph, unit hydrographs for different durations, unit hydrograph for complex storms.

Unit IV

Flood frequency studies: Introduction, Design flood. Frequency analysis using Gumbel's method and log Pearson type III distribution

Flood Routing: basic equations of flood routing, hydrologic channel routing through reservoirs and channels

Unit V

Reservoir Planning: Types of reservoir, Reservoir planning, Site selection, Storage zones, Reservoir yield, Mass curve and determination of storage capacity and yield. Reservoir sedimentation, sedimentation control, advanced topics

Text Books

- Engineering Hydrology. K. Subramanya, Tata McGraw Hill
- Water Resource Engineering. K.C. Patra. McGraw Hill

Reference Books

- Surface Water Quality Modeling. Chapra, Lewis Publication
- Physical Hydrology, (Second Edition); Fetter,
- Hydrology and Hydraulic Systems, Gupta, Third Edition

EDUCATIONAL TOURS/VISITS/SEMINARS

Paper Code	**EM - 761**	**(Lectures-Tutorial-Practical)/Week**	**(0-3-0)**
Credits	**2**	**Course Marks (Mid-End-Total)**	**(30-20-50)**

Course Objectives

- The purpose of educational tour is to provide an exposure to the students of various processes involved in industries/ typical ecosystems, environmental issues associated with them & a hands on exposure of developing an environmental management plan for the same.
- Students are motivated to critically examine various environmental aspects of industries / ecosystems visited by them.

Course Learning Outcome

- Environmental Engineers becomes fully aware of various processes involved in industries/ typical ecosystems, environmental issues associated with them & a hands on exposure of developing an environmental management plan.

Course Description

Visit to medium and large scale industry / environmentally significant structures/settings e.g. reservoir, lake, dam, coastal area, back-water, forest wetland etc.
Study of environmental policies issues and problem, presentation of environmental status report and recommendation for possible improvements.

Project Part I

Paper Code	**EM – 751A**	**(Lectures-Tutorial-Practical)/Week**	**(0-0-6)**
Credits	**6**	**Course Marks (Mid-End-Total)**	**(90-60-150)**

Course Objectives

- The purpose of educational tour is to provide an exposure to the students of various processes involved in industries/ typical ecosystems, environmental issues associated with them & a hands on exposure of developing an environmental management plan for the same.
- Students are motivated to critically examine various environmental aspects of industries / ecosystems visited by them.

Course Learning Outcome

- Environmental Engineers becomes fully aware of various processes involved in industries/ typical ecosystems, environmental issues associated with them & a hands on exposure of developing an environmental management plan

SIXTH SEMESTER

Project Part II

Paper Code	**EM – 751F**	**(Lectures-Tutorial-Practical)/Week**	**(0-0-6)**
Credits	**6**	**Course Marks (Mid-End-Total)**	**(180-120-300)**

Course Objectives
• The purpose of project II is to provide an exposure to the students about basics of data analysis, interpretation of results and carrying out research on various processes involved in industries/ municipal wastewater treatment, typical ecosystems, environmental issues associated with them & a hands on exposure of developing an environmental management plan for the same • Students are motivated to critically examine experimentally and analytically to evaluate various problems on water and wastewater

Course Learning Outcome
• Environmental Engineers becomes fully aware of various processes involved in industries/ typical ecosystems, environmental issues associated with them & a hands on exposure of data analysis

SYLLABUS

MASTER OF TECHNOLOGY (M. Tech.)
EARTHQUAKE ENGINEERING

Department of Civil Engineering
Faculty of Engineering & Technology
JamiaMilliaIslamia
New Delhi – 110025 (India)
http://www.jmi.ac.in/
July 2011

Preface

Civil Engineering is the oldest branch in the engineering and technological field with its versatility in application. Earthquake Engineering is an important specialization in Civil Engineering as seismic analysis and design is essential component for the safe Civil Engineering structures. The M. Tech. in Earthquake Engineering program is one of the newest programs of the department and started in the year 2011. This specialized post graduate program is being offered by very few institution of the country.

The human needs are being upgraded rapidly with time and new technology and products are being produced to meet the requirements. To keep the pace with time, the syllabus of M. Tech. (Earthquake Engineering) program is devised in the present form based on the suggestions of experts, academicians, persons working in the industry and researchers and on the feedback of the stakeholders. The latest trend in the industry and research field is combined with advanced knowledge of each subject while making the syllabus. The courses will help the students to make strong base for working in academic, research and industry environment.

The course consists of theoretical and laboratory components with seminar presentation and dissertation which will give the opportunity to the students to develop their skills in the field of Earthquake Engineering. The program consists of core course as well as elective courses. The elective courses are designed; provide the flexibility to students to choose on their choices. The latest softwares related to the various courses are available in the software laboratory to make the student abreast.

I wish to acknowledge the hard work put in by the faculty members in the updating and revision of syllabus. I also wish to convey my sincere thanks to the subject experts who gave their valuable inputs in finalizing this syllabus.

Professor Mohammad Shakeel
Head

About The University

Jamia Millia Islamia, an institution originally established at Aligarh in United Provinces, India in 1920 became a Central University by an act of the Indian Parliament in 1988. In Urdu language, Jamia means 'University', and Millia means 'National'.

The story of its growth from a small institution in the pre-independence India to a central university located in New Delhi—offering integrated education from nursery to research in specialized areas—is a saga of dedication, conviction and vision of a people who worked against all odds and saw it growing step by step. They "built up the Jamia Millia stone by stone and sacrifice by sacrifice," said Sarojini Naidu, the nightingale of India.

Under the colonial British rule, two dominant trends joined hands and contributed towards in the birth of Jamia. One was the anti-colonial Islamic activism and the other was the pro-independence aspiration of the politically radical section of western educated Indian Muslim intelligentsia. In the political climate of 1920, the two trends gravitated together with Mahatma Gandhi as a catalyst. The anti-colonial activism signified by the Khilafat and the pro-independence aspirations symbolised by the non-cooperation movement of the Indian National Congress helped to harness creative energies and the subsequent making of Jamia Millia Islamia. Rabindranath Tagore called it "one of the most progressive educational institutions of India".

Responding to Gandhiji's call to boycott all educational institutions supported or run by the colonial regime, a group of nationalist teachers and students quit Aligarh Muslim University, protesting against its pro-British inclinations. The prominent members of this movement were Maulana Mehmud Hasan, Maulana Mohamed Ali, Hakim Ajmal Khan, Dr. Mukhtar Ahmad Ansari, and Abdul Majid Khwaja. Hakim Ajmal Khan, Dr. Mukhtar Ahmed Ansari and Abdul Majeed Khwaja supported by Gandhiji shifted Jamia from Aligarh to Karol Bagh, in New Delhi in 1925. In 1925, after long deliberation, a group of three friends studying in Germany—Dr. Zakir Husain, Dr. Abid Husain and Dr. Mohammad Mujeeb—decided to serve Jamia.

One of the first steps they took was the introduction of the hugely popular evening classes for adult education. This movement was later to become, in October 1938, an institution called Idara-i-Taleem-o-Taraqqi.

In 1928 Hakim Ajmal Khan passed away. That was the beginning of the second financial crisis, as it was Hakim Sahib himself who had been meeting most of Jamia's

financial needs. The leadership of Jamia then moved into the hands of Dr. Zakir Husain, who became its Vice Chancellor in 1928. To resolve Jamia of these frequent crises, a group of young Jamia teachers, led by Dr. Zakir Husain, took a pledge to serve Jamia for the next twenty years on a salary not more than Rs. 150. This group was called the Life Members of Jamia. (History repeated in 1942 when a second group of Jamia teachers took a similar pledge).

Jamia's department of Printing and Publications was trifurcated in 1928 with the newly established Jamia Press at Darya Ganj, Urdu Academy, and Maktaba Jamia under the charge of Prof. Mohammad Mujeeb, Dr. Abid Husain and Mr. Hamid Ali respectively.

On 1st March 1935, the foundation stone for a school building was laid at Okhla, then a non-descript village in the southern outskirts of Delhi. In 1936, all institutions of Jamia, except Jamia Press, the Maktaba and the library, were shifted to the new campus. The basic emphasis of Jamia was on evolving innovative education methods. This led to the establishment of a teacher's college (Ustadon ka Madrasa) in 1938.

The fame of Jamia as an innovative education movement spread and dignitaries from foreign countries began visiting Jamia. Husein Raouf Bey (1933), Dr. Behadjet Wahbi of Cairo (1934), Ms. Halide Edib of Turkey (1936) were some of them. Foreigners, impressed by Jamia, began working in Jamia. The German lady Ms. Gerda Philipsborn (popularly known as Aapa Jaan) served Jamia for many years is buried in Jamia.

In 1939, Maulana Ubaidullah Sindhi (1872-1944), a theologian and freedom fighter, came to stay in Jamia on the invitation of Dr. Zakir Husain. He started a school of Islamic Studies in Jamia, called Baitul Hikmal, propagating the ideology of Shah Waliullah. Zakir Husain, later the President of India, recalled those days of indestructible optimism in the face of depravity 'when they had a longing to build and nothing to build with, as "days of joy".

After the attainment of Independence, Jamia continued to grow as an academic institution with a difference. Many foreign dignitaries made it a point to visit Jamia Millia Islamia during their visits to New Delhi. Among those who visited Jamia include Marshal Tito (1954), king Zahir Shah of Afghanistan (1955), crown prince Faisal of Saudi Arabia, king Reza Shah Pehlavi of Iran (1956) and prince Mukarram Jah (1960).

In 1962, the University Grants Commission declared the Jamia a 'deemed to be University'. Soon thereafter, the School of Social Work was established in 1967. In

1971, Jamia started the Zakir Husain Institute of Islamic Studies, to honour Dr. Zakir Husain, who had passed away in 1969. BE course in Civil Engineering commenced in 1978; in 1981, the faculties of Humanities and Languages, Natural Sciences, Social Science, and the State Resource Centre were founded. In 1983, it started the Mass Communication Research Centre and the Centre for Coaching and Career Planning. In 1985, it established the Faculty of Engineering & Technology and the University Computer Centre. Academic Staff College and the Academy of Third World Studies followed in 1987 and 1988.

By a Special Act of the Parliament, Jamia Millia Islamia was made a central university of India in December 1988.

At present Jamia has Nine faculties and a number of centres of learning and research, like AJK-Mass Communication Research Centre (MCRC), Academy of International Studies etc. The Jamia is also marching ahead in the field of Information Technology (IT). It offers various undergraduate and postgraduate IT courses. Apart from this, the Jamia has a campus wide network which connects a large number of its departments and offices.

About the Department

The Department of Civil Engineering is one of the oldest and the largest department in the Faculty of Engineering & Technology. The department has produced several eminent engineers who have made important contributions in the planning and execution of many important Civil Engineering projects in India as well as abroad.

The Department offers two undergraduate courses in Civil Engineering. The Department also offers Master's programme with specialisations in Environmental Engineering and Earthquake Engineering .In all, there are around 560 students in undergraduate programme and 75 students pursuing their Masters degree. These courses are supported with strong doctoral programmes in all the major specialisations of Civil Engineering. More than 45 Ph. D. research scholars including many from foreign countries are currently working in the department on emerging research areas.

The Department is known for its reputed faculty with expertise in diverse fields. Presently, the department has 23 highly qualified, experienced, sincere and dedicated teaching faculty members, actively participating in research and consultancy work. During last 5 years, faculty members have published more than 280 papers in reputed refereed International Journals.

Over a period of time, the Department has built up a wide research potential. The research programmes of the department are funded by various agencies such as Ministry of Human Resource Development (MHRD), Department of Science & Technology (DST), Ministry of Environment & Forests (MoEF), Central Pollution Control Board (CPCB), All India Council of Technical Education (AICTE), University Grants Commission (UGC), Ministry of Steel and Ministry of Urban Development. Major area of research in the Department include; Sustainable Development, low cost sanitation, water treatment, air, noise and water quality modelling, Reuse of concrete, application of GIS and remote sensing in water resources and environment, Vulnerability assessment, Seismic analysis of structures, retrofitting, Soil structure interaction, Hydro-climatology, Water resource assessment and management.

The Department has established a state of the art experimental facilities and laboratories in different fields of Civil Engineering. It has received the prestigious funding under FIST from DST and SAP from UGC. The Department has mobilized more than Rs 250 millions from various external agencies to carry out research in cutting edge technologies in different fields of Civil Engineering.

The faculty also renders technical advice on live engineering problems to various Government and Private Sector companies throughout the country. These live projects are effectively used as training desk for our students at undergraduate and postgraduate levels. RITES, Military Engineering Services, Municipal Corporations of Delhi, Faridabad, Gurgaon, Gaziabad, NOIDA, PWD, CPWD, DDA, HUDA, Jal Nigam etc. regularly hire services for technical advice and vetting of designs of infrastructure projects. The Department has generated around Rs 800 million through consultancies during the last five years.

International and national conferences, seminars and special lectures are a regular feature of the Department to impart education and training. The Department has active collaboration with academics and industry such as University of Applied Sciences Erfurt (Germany), Wessex Institute (UK), University of Waterloo (Canada), Asian Institute of Technology (Bangkok) and Steel Authority of India (INDIA).

Leading MNCs and public sectors are regular recruiter of our students and many students have been selected in Engineering Services. Several of our alumni pursued higher education in USA, UK, Germany, Canada, Australia and France and have been appointed as faculty members and consultants abroad.

The Department strongly believes in continuous efforts to strive for excellence by exploring new frontiers of knowledge, imparting the latest technical knowledge to the students and conducting high quality research.

Program Educational Objectives

The **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)** are the statements that describe the expected achievements from the programme. They are guided by global and local needs, the vision of the department, long term goals etc. The Programme Educational Objectives of M-Tech in Earthquake Engineering includes:

1. The graduates will engage in the technical education of Earthquake Engineering across a range of application areas including analysis and design of earthquake resistant structures, computational methods etc.
2. The graduates will experience successful careers and provide leadership and will have an ability to continuously adapt to meet the challenges of a changing environment.
3. The graduates will be well prepared for pursuing further studies in India and abroad as well.
4. The graduates will be groomed to serve the society and country by making new products, technology and software.
5. The graduates will be prepared to lead the academic, research organizations and consultancies.

Program Outcomes

The curriculum and syllabus for M-Tech Earthquake Engineering program conform to result oriented teaching learning process. In general, **TEN PROGRAM OUTCOMES (POs)** have been identified and the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these outcomes. Program outcomes are statements that describe significant and essential learning that students have achieved, and can reliably demonstrate at the end of a course or program.

Students of the earthquake engineering program will be able to:

1. Apply knowledge of mathematics, science, and engineering to solve the problems related to Earthquake Engineering.
2. Design and conduct experiments of structural dynamics and seismology, to solve the engineering problems many latest softwares, and analyze the experimental data.
3. Design earthquake resistant structures considering safety, efficiency, elegance and economy
4. Work in engineering and non-engineering multidisciplinary teams to complete an assigned project.
5. Identify, formulate with mathematical modelling, and solve the engineering problems using different computational tools and perform laboratory experiments (if required).
6. Understand professional and social responsibility and understand the impacts of engineering solution on the society, environment, country, and on universe as well.
7. Communicate efficiently in their profession and career with team members, colleagues and with the society at large orally, in writing and presentation.

8. Identify new problems for research, solution and application of the problems, ability to update the latest knowledge in research and industry, ability to go for higher studies and research organization and in the consultancy.
9. Apply the knowledge to study latest events of earthquake and adopt new methodology for analysis and earthquake resistant design of structures with latest architecture and materials.
10. Apply the knowledge to run the latest software related to analysis and design of structures, develop new software in this field including new techniques, tools and practices.

Course Structure

First Semester

Course No.	Course Title	Credit	*Period per week*			*Marks*		
			L	**T**	**P**	***Mid Sem***	***End Sem***	**Practical**
MEQ-101	Advance Structural Analysis	4	3	1	--	40	60	--
MEQ -102	Theory of Vibrations	4	3	1	--	40	60	--
MEQ- 103	Finite Element Method	4	3	1	--	40	60	--
MEQ-104	Seismology and Geotechnical Earthquake Engineering	4	3	1	--	40	60	--
MEQ-105	Analysis and Design of Tall Buildings	4	3	1	--	40	60	--
MEQ-150	Structures / Seismology Laboratory	3	--	--	6	45	--	30
Total		**23**	**15**	**5**	**6**	**245**	**300**	**30**
Total credit = 23			**Total Periods Per week = 26**			**Total Marks = 575**		

Second Semester

Course No.	Course Title	Credit	*Period per week*			*Marks*		
			L	**T**	**P**	***Mid Sem***	***End Sem***	**Practical**
MEQ-201	Optimization Techniques	4	3	1	--	40	60	--
MEQ -202	Fundamental of Earthquake Analysis	4	3	1	--	40	60	--
MEQ -203	Earthquake Resistant Design of Structures	4	3	1	--	40	60	--
MEQ -204	Elective – I	4	3	1	--	40	60	--
MEQ -205	Elective - II	4	3	1	--	40	60	--
Total		**23**	**15**	**5**	**0**	**200**	**300**	**--**
Total credit = 23			**Total Periods Per week = 20**			**Total Marks = 500**		

Third Semester

Course No.	Course Title	Credit	Period per week			Marks		
			L	T	P	Mid Sem	End Sem	Practical
MEQ-301	Advance RCC Design	4	4	-	-	40	60	--
MEQ-304	Seminar	2	-	-	4	-	--	50
MEQ-305	Dissertation	6	-	6	6	90	--	60
MEQ-302	Software Laboratory	2	-	-	6	30	--	20
MEQ-303	Structural Dynamics Lab	3	-	-	6	45	--	30
Total		**17**	**4**	**6**	**22**	**205**	**60**	**160**
Total credit = 17			**Total Periods Per week = 32**			**Total Marks = 425**		

Fourth Semester

Course No.	Course Title	Credit	Period per week			Marks		
			L	T	P	Mid Sem	End Sem	Practical
MEQ-401	Dissertation	12	-	12	12	180	120	--
Total		**12**	**--**	**12**	**12**	**180**	**120**	**--**
Total credit = 12			**Total Periods Per week = 24**			**Total Marks = 300**		

FIRST SEMESTER

ADVANCE STRUCTURAL ANALYSIS

Paper Code	**MEQ -101**	**(Lectures-Tutorial-Practical)/Week**	**(3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total)**	**(40-60-100)**

Course Objectives

- To make clear understanding for idealization of various structural forms and supports to carry different lo0adings
- To make the students understand basic methods of structural analysis of framed structures, Plates and Shells to interpret the results obtained from software analyses.
- To perform manual analysis of structures and compare them with those obtained from software

Course Learning Outcome

- Will be able to Idealize structures and their supporting system
- Will have clear understanding of the response of the structures under different loadings
- Will be able perform analysis of structures confidently

Course Description

Unit-I

Methods of Structural Analysis, Structural idealization, Types of Framed Structures, Deformations in Framed Structures, Actions and Displacements, Static and Kinematic Indeterminacy, Actions and Displacement Equations, Flexibility and Stiffness Matrices, Equivalent Joint Loads, Energy Concepts and Virtual Work

Unit-II

Flexibility Method, Temperature Changes, Pre strains, Support Displacements, Joint Displacements, Member End Actions, Support Reactions, Formalization of Flexibility Method

Unit-III

Stiffness Method, Temperature Changes, Pre strains, Support Displacements, Joint Displacements, Formalization of Stiffness Method, Direct Stiffness Method, Formation of Joint

Stiffness Matrix, Formation of Load Vector, Rotation of Axes in Two Dimensions, Rotation Matrix, Rotation Transformation Matrix, Rotation of Axes in Three Dimensions, Rectangular Framing, Use of Symmetry and Anti-symmetry, Loads Between Joints and Transfer Matrix, Oblique Supports and Elastic Supports, Member Stiffnesses and Fixed End Actions from Flexibilities, Non prismatic and Curved Members, Discontinuities in Members, Shearing Deformations

Unit-IV

Plastic Analysis, Introduction, Elastic Analysis versus Plastic Analysis, Ultimate Moment, Newton Raphson's Technique Plastic response of a Simple Beam, Ultimate Strength of Fixed and Continuous Beams, Rectangular Portal Frames, Plastic Hinge under Distributed Loads, Frames with Inclined Members, Effect of Axial Load and Shear on Plastic Moment Capacity, Nonlinear Analysis, Geometric Stiffness Matrix, Modified Newton Raphson's Technique

Unit-V

Thin and Thick Plates, Kirchoff-Love Plate Theory of Thin Plates, Navier's and Levi's Solutions, Numerical and Approximate Methods, Deformations of Shells without Bending

Text Books

- Matrix Analysis of Framed Structures, William Weaver Jr. and James M. Gere, CBS Publidhers
- Structural Analysis, A. Ghali and A. m. Neville, E & FN SPON

Reference Books

- Analysis and Behaviour of Structures, Rossow, G.C, Prentice Hall
- Analysis of Structural Systems, Fleming, J. F., Prentice Hall

Software or other Requirement

- STAAD PRO
- ETAB

THEORY OF VIBRATIONS

Paper Code	**MEQ-102**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- To impart fundamentals of structural dynamics to M. Tech students in Earthquake Engineering.
- To teach them solution techniques used for solving dynamic problems.
- To prepare them for understanding seismic analysis of structures offered in the subsequent semester.
- To offer them the ability to think and handle real life dynamic problems.

Course Learning Outcome

- Will acquire knowledge of the fundamentals of structural dynamics.
- Will be able to pursue advanced level courses in dynamics and in related application areas.
- Will be able to handle real life dynamic problems.

Course Description

Unit-I

Sources of dynamic loading, concepts of oscillation and SHM, inertia force, restoring force, damping force, modeling of damping, free and forced vibration of SDOF, determination of damping co-efficient

Unit-II

Solution of equation of motion of SDOF in time & frequency domains for irregular loading, FRF, transient dynamics, support motions

Unit-III

Equations of motion of MDOF system, generation of stiffness matrix for dynamic d.o.f, eigen-value problem, mode shapes & frequencies, support motions, solution for irregular loading in time and frequency domain

Unit-IV

Normal mode theory, mode acceleration approach, solution using FFT and IFFT, FRF,

solution for irregular support motion, modal response spectrum analysis

Unit-V

Continuum system, Rayleigh's method for approx frequency calculation, normal mode analysis, wave propagation analysis

Text Books

- Dynamics of Structures; R.W. Clough and J. Penzien; McGraw Hill (Student Edition)
- Dynamics of Structures: Application to Earthquake Engineering; Prentice Hall (Student Edition)
- Theory of Vibration with Application; W.T. Thomson; Prentice Hall

Reference Books

- Dynamics of Structures, Hurtey, W.C. and Rubinstein, M.F.; Prentice Hall
- Structural Dynamics for Structural Engineers, Hart, G.C., Wong, K.K.F., and Wong, K.; John Wiley
- Siesmic Analysis of Structures; Datta, T.K.; John Wiley

FINITE ELEMENT METHOD

Paper Code	**MEQ- 103**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- Develop the finite element equations to model engineering problems
- Apply finite element method to formulate and solve structural problems
- Solve differential equations using the approximate numerical methods

Course Learning Outcome

- Students will be able to use concept of science, engineering and mechanics in the subject
- Students will be able to use the concept of the subject for using FEM softwares
- Students will be able to identify, formulate and solve engineering problems applying FEM

Course Description

Unit-I

Introduction, brief history, general steps in FEM, applications, advantages; Introduction to the stiffness method, definition of stiffness matrix for a spring element, assemblage, assembling the total stiffness matrix by superposition (direct stiffness method), boundary conditions, potential energy approach to drive spring element equations; Development of truss equations: development of stiffness matrix for a bar element in local coordinates, approximate functions for displacement, transformation of vector in 2D, global stiffness matrix, computation of stress for a bar in 2D plane, solution of a plane truss, transformation matrix & stiffness matrix for a bar in 3D space, use of symmetry in structures, inclined supports, Galerkin's residual method.

Unit- II

Development of Beam Equations: Introduction, beam stiffness, assemblage of beam stiffness matrices, distributive loading, beam element with nodal hinge; Frame & Grid Equations: introduction, 2D arbitrarily oriented beam element, rigid plane frames, inclined support-frame elements, grid equation, beam element arbitrarily oriented in space, sub structure analysis; Plane

stress & plain strain, basic concept, derivation of constant strain triangular element stiffness matrix & equations, body & surface forces, explicit expression for CST stiffness matrix, FEM solution of a plane stress problem

Unit- III

Finite element modeling, equilibrium & compatibility of finite element results, static condensation, development of linear strain triangle equations, derivation of LS triangular element stiffness equation, axisymmetric elements, derivation of stiffness matrix; Isoparametric Formulation; bar element stiffness matrix, rectangular plane stress element, plane element stiffness matrix, higher order shape functions.

Unit- IV

3D stress analysis, tetrahedral element, isoparametric formulation; Plate Bending Element: basic concept of plate bending, derivation of plate bending element stiffness matrix & equations; Heat transfer and mass transport: derivation of basic equations, 1D FE formulation, FE formulation of heat transfer with mass transport; Fluid flow in porous media and through hydraulic networks: Derivation of basic equations, 1D FE formulation; Electrical Networks and Electrostatics.

Unit- V

Thermal stress, formulation of thermal stress problems; Structural Dynamics: determination of bar element equations, natural frequency of 1D bar, beam element mass material & natural frequencies, truss, plane frame, plane stress/strain axisymmetric & solid element mass matrix

Text Books

- Finite Elements and Approximation, Zienkiewicz, O. C. and Morgan, K., John Wiley & Sons
- Finite Element Method, Reddy, J.N., McGraw-Hill Book Company
- Finite Element Procedures, Bathe, K. J., PHI Learning

Reference Books

- A Unified Approach to the Finite Element Method and Error Analysis Procedures, Dow, J.O., Elsevier.
- Concepts and Applications of Finite Element Method, Cook, R.D., Malkus, D., Plesha, M. and Witt, J., John Wiley & Sons

Software or other Requirement

- ANSYS
- ABAQUS
- MATLAB, STAAD PRO

SEISMOLOGY AND GEOTECHNICAL EARTHQUAKE ENGINEERING

Paper Code	**MEQ-104**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- Provide the students with an introduction of seismology and advanced level understanding of the mechanisms of earthquakes and measurement of strong ground motions
- Enable the students to conduct ground response analysis
- Enable the students to perform seismic slope stability analysis/design
- To study the seismological activity of the earth in response to sub-surface strata
- Micro-zonation analysis of different earthquake zones in India.

Course Learning Outcome

- Have advanced understanding of seismology, including plate tectonics, faults, waves induced by earthquakes, and size of earthquakes
- Be able to use strong ground motion data in earthquake engineering analysis/design
- Be able to perform site response analysis
- Be able to evaluate liquefaction resistance and assess liquefaction potential using field data

Course Description

Unit-I

Introduction to the hazards of earthquakes: strong ground motions, tsunamis, landslides, liquefaction. Review of plate tectonics. Seismic hazard in Puerto Rico and beyond; Maths review: Fourier Transforms Single degree of freedom dynamics, damped vibrations. Convolutions, Green's Functions; A seismic station: sensors and data loggers. Poles and zeros for sensor response; Mechanical and digital sensor design and performance

Unit-II

Interpretation of Seismic Records - acceleration, velocity and displacement; Issues with strong

ground motions and record parameterisation; Theory of wave propagation: Body waves Theory of wave propagation: Surface waves

Unit-III

Dynamic Soil Properties: Stress & strain conditions, concept of stress path; Measurement of seismic response of soil at low and high strain, using laboratory tests; Cyclic triaxial, cyclic direct simple shear, resonant column, shaking table, centrifuge and using field tests - standard penetration test, dynamic plate load test, block vibration test, SASW/MASW tests, cross bore hole; Evaluation of damping and elastic coefficients; Stress-strain behavior of cyclically loaded soils; Effect of strain level on the dynamic soil properties; Equivalent linear and cyclic nonlinear models; Static and dynamic characteristics of soils.

Unit-IV

Background and lessons learnt from damages in past earthquake; Wave in infinite & semi-infinite media –one, two and three dimensional wave propagation; Attenuation of stress waves – material and radiation damping; Dispersion, wave in a layered media; Determination of Dynamic Soil Properties as per IS-5249; Ground Response Analysis: Introduction one, two and three dimensional analyses; Introduction to soil-structure interaction

Unit-V

Evaluation of liquefaction potential: characterization of earthquake loading and liquefaction resistance, cycle stress ratio, Seed and Idress method; Effects liquefaction; Seismic design of retaining walls: types, modes of failure, static pressure, seismic response (including M-O method), seismic displacement, design consideration; Types of earthquake induced landslides; Evaluation of slope stability: stability analysis with dynamic loading, friction circle method, effective and total stress methods of analysis, yield acceleration, damage potential, displacement analysis, effect of saturated and submerged conditions, FEM analysis of slope stability

Text Books

- International Handbook of Earthquake and Engineering Seismology. Lee, W.H.K, Kanamori, H., Jennings, P.C., Kissinger, C., Academic Press
- Introduction to Seismology. Shearer, P. M., Cambridge University Press
- Geotechnical Earthquake Engineering. Kramer, S. L., Prentice Hall
- Soil Dynamics, Prakash, S., McGraw Hill Book Company.

Reference Books

- An Introduction to Seismology, Earthquakes and Earth Structure. Stein, S. and Wysession, M., Blackwell Publishing
- Modern Global Seismology. Lay, T., and Wallace, T. C., Academic Press

ANALYSIS AND DESIGN OF TALL BUILDING

Paper Code	**MEQ - 105**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- To familiarize students with the recent developments in seismic analysis and design of tall buildings from the perspective of efficient use in design offices leading to latest research in this area like prescriptive design methods and modern performance-based design methods for tall buildings
- Understand common structural systems utilized in tall buildings and their design philosophy.
- Perform preliminary design and analysis of various structural systems for tall buildings.

Course Learning Outcome

- Develop analytical models for tall buildings using latest structural analysis programs, and to assess structural response under seismic excitation using such analytical tools..
- Effectively participate in structural design of tall buildings for specified performance objectives at component and system levels.

Course Description

Unit-I

Structural system and concept; Approximate methods for analysis of multistoried frames; Analysis of symmetric frames, mass irregularities in plane and elevation; Analysis for torsions in buildings

Unit-II

Design of building with shear walls and coupled walls; Effect of openings; Design specifications and I.S. codes

Unit-III

Behavior of framed tube systems, tube in tube system and blended tube system; Simplified analytical models for symmetrical tubular structures

Unit-IV
Design of Raft and Pile Foundations

Text Books

- Tall Building Structures: Analysis and Design, Bryan Stafford Smith & Alex Coull, Wiley India Pvt. Ltd.
- Foundation Engineering, P.C. Varghese, PHL Learning Private Limited.
- High Rising Building Structures, Wolfgang Schueller, Robert E. Krieger Publishing Company.
- Reinforced Concrete Structures, Arthur, H.N., McGraw-Hill.

Reference Books

- Structural Analysis and Design of Tall Buildings: Steel and Composite Construction, Bungale S. Taranath, CRC Press
- Structural Analysis, A. Ghali and A.M. Neville, E & FN SPON
- The Seismic Design Handbook, Farzad Naeim, Kluwer Academic Publishers.
- Handbook of Concrete Engineering Author:- Mark Fintel, Publication:- CBS Publications & Distributors

Software or other Requirement

- STAAD
- ETAB
- SAP
- ANSYS

SECOND SEMESTER

OPTIMIZATION TECHNIQUES

Paper Code	**MEQ -201**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- To make clear understanding of various Optimization Techniques and Optimality Criteria.
- To make the students understand basic methods of Optimization such as Powell's conjugate direction method, Simplex method. Gradient based methods: Cauchy's (Steepest descent) method, Conjugate gradient method, Newton's method, Variable metric (DFP) method, BFGS method.
- To make the students understand Constrained Optimizations Techniques
- To understanding of various Specialized Optimizations techniques ¾ Dynamic programming, Geometric programming, Genetic Algorithms

Course Learning Outcome

- Will be able to optimize structures and their supporting system
- Will have clear understanding of basic methods of Optimization
- Will be able to understands the Specialized Optimizations techniques

Course Description

Unit-I

I**ntroduction**; Problem formulation with examples; Single Variable Unconstrained Optimizations Techniques ¾ Optimality Criteria. Bracketing methods: Unrestricted search, Exhaustive search, Region Elimination methods: Interval Halving methods, Dichotomous search, Fibonacci method, Golden section method.

Unit-II

Interpolation methods: Quadratic Interpolation method, Cubic Interpolation method; Gradient Based methods: Newton-Raphson method, Secant method, Bisection method. Multi Variable Unconstrained Optimisation Techniques ¾ Optimality Criteria, Unidirectional Search. Direct Search methods: Random search, Grid search, Univariate method, Hooke's and

Jeeves' pattern search method, Powell's conjugate direction method, Simplex method.

Unit-III

Gradient based methods: Cauchy's (Steepest descent) method, Conjugate gradient (Fletcher-Reeves) method, Newton's method, Variable metric (DFP) method, BFGS method. Constrained Optimisation Techniques ¾ Classical methods: Direct substitution method, Constrained variation method, method of Lagrange multipliers, Kuhn-Tucker conditions. Linear programming problem: Standard form, Simplex method.

Unit-IV

Indirect methods: Elimination of constraints, Transformation techniques, and Penalty function method. Direct methods: Zoutendijk's method of feasible direction, Rosen's gradient Projection method

Unit-V

Specialized Optimisation techniques ¾ Dynamic programming, Geometric programming, Genetic Algorithms

Text Books

- Engineering Optimisation – Theory and Practice , S. S., New Age International, Rao
- Optimisation for Engineering Design – Algorithms and examples, Deb, K., Prentice Hall

Reference Books

- Optimum Structural Design, Kirsch U., McGraw Hill.
- Introduction to Optimum Design, Arora J S. McGraw Hil

Software or other Requirement

- ETAB

FUNDAMENTALS OF EARTHQUAKE ANALYSIS

Paper Code	**MEQ -202**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- To impart the knowledge of structural dynamics (taught in the previous semester) for the analysis of structures for earthquake excitation.
- To understand the analysis of structures for different kinds of seismic excitation namely, time history records, FFT, power spectral density function and response spectrum.
- To acquaint the student with the frequency domain, time domain and non linear analyses including ductility.

Course Learning Outcome

- The students will learn available techniques for earthquake analysis of structures.
- The students will be able to use standard softwares for the seismic analysis of structures.
- Students will be able to model a structure for seismic analysis using right type of input and also, will be able to physically understand the results of the analysis.

Course Description

Unit-I

Seismology including seismic hazard analysis, various types of seismic inputs- time history, fourier spectrum, power spectral density function, design response spectrum, attenuation relationship

Unit-II

Analysis of structures for specified ground motion, time history analysis, frequency domain analysis, cases of multi supports excitation, modal analysis and mode acceleration approach

Unit-III

Spectral analysis of structures for random ground motion, case of single point excitation and multi point excitation, response analysis for partially correlated ground motion, modal spectral analysis

Unit-IV

Response spectrum method analysis for structures, single point excitation and multi points excitation, base shear approach, response spectrums provided in different codes and their critical appraisal

Unit-V

Inelastic response analysis of structure for earthquake, cases of single degree and multi degree freedom system, pushover analysis, concept of ductility, inelastic spectrum and ductility behaviour of tall buildings

Text Books

- A. K. Chopra, Structural Dynamics for Earthquake, Prentice Hall
- T. K. Datta, Seismic Analysis of Structures, John Wiley

Reference Books

- R.W. Clough and J. Penzien, Dynamics of Structures, McGraw Hill International

Software or other Requirement

- ETAB
- STAAD PRO

EARTHQUAKE RESISTANCE DESIGN OF STRUCTURES

Paper Code	**MEQ -203**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- To impart the knowledge of required seismic input for earthquake resistant design, in particular response spectrum given in code.
- To acquaint the students with seismic design philosophy of structures (concrete, steel and masonry) consistent with code provisions and practices.
- To make the students aware of the seismic behavior of different structural components and accordingly use fundamentals of flexural and combined flexural cum shear design for the elements.

Course Learning Outcome

- The students will be able to effectively analyse and design the structures for seismic forces.
- Students will be able to understand ductile design and detailing of joints.
- Students would learn important code provisions for the seismic design of structures and would understand properly the basis of the code provisions.

Course Description

Unit-I

Modeling of Reinforced Concrete and Masonry buildings, response spectrum for with special emphasis on Code spectrum, Equivalent static Analysis, Seismic design philosophy, concept of strength, over strength, ductility and capacity design

Unit-II

Seismic Design of Building Components: Seismic resistant properties of reinforced concrete; Seismic behavior and design of linear reinforced concrete elements; Seismic behavior of planar reinforced concrete elements, code provisions

Unit-III

Seismic Provisions for Structural Steel Buildings: Materials, connections, joints and fasters;

Columns, ordinary, intermediate and special moment resisting frame; Con-centrically and eccentrically braced frames, code provisions

Unit-IV

Behaviour of masonry structures and earthquake resistant measures, Analysis for earthquake forces, role of floor and roof diaphragm; Concept and design of bands, bandages, splints and ties; Reinforced masonry; Vertical reinforcement at corners and jambs; Measures in random-rubble masonry; Confined masonry; Code provisions. Masonry Infills: Effect of masonry infills on seismic behaviour of framed buildings; Failure modes; Simulation of infills – FEM and equivalent strut; Safety of infills in in-plane action – shear, compression and buckling; Out-of-plane action, arching, code provisions, retrofitting of masonry building

Text Books

- Seismic Design of Reinforced Concrete and Masonry Buildings, Pauley, T. and Priestley, M.J.N, John-Wiley & Sons
- Elements of Earthquake Engg. and Structural Dynamics, Andre Filiatrault, Overseas Press India Pvt. Ltd.
- Earthquake Resistant Design of Structures, Pankaj Aggarwal and Manish Shrikhande, Prentice Hall of India Ltd

Reference Books

- Reinforced Masonry Design, Schneider, R.R. and Dickey, W.L, 3nd Ed., Prentice Hall
- Concrete Structure in earthquake regions, Edmund Booth, Design & Analysis" Longman Scientific & Technical

Software or other Requirement

- ETAB
- STAAD PRO

OFFSHORE STRUCTURES

Paper Code	**MEQ-204**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- To have a sound knowledge of offshore structures.
- To study different wave theories for understanding sea characteristics.
- To study wind and wave forces in offshore environment.
- To acquire fundamental understanding of behavior of different kinds of offshore platforms under sea environment.

Course Learning Outcome

- After completion of the course, student will be able to have a sound knowledge of offshore structures.
- Understand different wave theories for understanding sea characteristics.
- Student will be able to understand to compute wind and wave forces in offshore environment.
- Student will understand fundamental behavior of different kinds of offshore platforms under sea environment.

Course Description

Unit-I

Introduction, Design of Fixed Offshore Structures, Examples of Fixed Offshore Structures, Analysis of Fixed Offshore Structures, Ocean Surface Waves, Wave Theories; Airy, Cnoidal and Stokes.

Unit-II

Environmental Loadings: Wind Speeds, Wind Forces, Wave Forces on Vertical Piles, Wave Forces on Arbitrarily Oriented Cylinders, Maximum Wave Force on an Offshore Structure, Joint Loads from Wave Forces, Buoyant Forces, Current Loadings, Additional Environmental Loadings.

Unit-III

Static Methods of Analysis, Design Environmental Conditions, Frame Analysis of Steel Offshore Structures, Bending Stress Amplification, Pressure induced stresses in steel structures, Design stress criteria for steel members.

Unit-IV

Analysis of Offshore Concrete Platforms, Pressure Induced Stresses in Concrete Structures; Effects of End Restraints, Spherical End Caps, Examination for Dynamic Effects, Dynamics of Structures, Lumped Description of Wave Forces.

Unit-V

Foundation Analysis: Soil Characteristics, Piles for Template Structures, Prediction of Axial Pile Capacity, Elastic response of Pile to Axial Loading, Footings for Offshore Structures, Bearing Capacity of Footings, Resistance of Footings to Sliding, Design of Footings subjected to General Loading Conditions.

Text Books

- Offshore Structural Engineering, Thomas H Dawson, Prentice-Hall, INC.
- Handbook of offshore engineering, S. K. Chakarbarti, Vol. 1&2, Elsevier Science

Reference Books

- Wave forces on offshore structures, Turgut Sarpkaya, Cambridge University Press.
- Dynamics of Offshore Structures, Minoo H. Patel, Butterworth & Co. Ltd.

Software or other Requirement

- SACS software for Fixed Platform's Design

RELIABILITY BASED DESIGN

Paper Code	**MEQ – 205**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- To teach the fundamentals of reliability & design philosophy and significance of reliability in structural design
- To train students for various probabilistic and stochastic theorems as well as models applicable to reliability structures.
- To teach various reliability methods for feuding out reliability index and system reliability

Course Learning Outcome

- Students will have the understanding of fundamentals of reliability and importance of reliability in structural design
- Students will be conversant with various probabilistic and stochastic process/models applicable to structural reliability
- Students can assess the reliability index and system reliability

Course Description

Unit-I

Nature of Structural Design and Safety: Evolution of design codes; Hazards, risks and economy of structural design, Uncertainty Modeling: Probability theory, random variables, probability distributions, moments, extreme value statistics, utility and descriptive statistics; Fuzzy set theory

Unit-II

Bayesian Decision Theory: A priori and posteriori probability; Bayes strategy and computation, Statistical Inference: Model estimation, hypothesis testing, confidence intervals and significance testing

Unit-III

Stochastic Models for Material Strengths: Classic strength models - ideal brittle material, idea plastic material, fiber bundle; Fatigue - damage accumulation laws, cycle counting,

damage statistics; Bogdanoff's cumulative damage model. Stochastic Models for Loads: Gust wind loads, wave loads, earthquake loads, traffic load and live load modeling; Stochastic theory of load combinations

Unit-IV

Reliability Methods: Multiple safety factor formats; Characteristic values; Reliability index and system reliability; code calibrations

Text Books

- Ang , A.H., S. and Tang, W.H.. "Probability Concepts in Engineering Planning and Design, Vol. I & II., John Wiley & Sons
- Blockley , D.I.. "The Nature of Structural Design and Safety", Ellis Horwood
- Augusti, G., Baratta, A. and Casciati, F., "Probabilistic Methods in Structural Engineering, Chapman & Hall

Reference Books

- Chernoff, H. and Moses, L.E., "Elementary Decision Theory", Dover Publications
- Elishakoff, I.., "Probabilistic Theory of Structures", 2nd edition, Dover Publications

THIRD SEMESTER

ADVANCE REINFORCED CONCRETE DESIGN

Paper Code	**MEQ – 301**	**(Lectures-Tutorial-Practical)/Week (3-1-0)**
Credits	**4**	**Course Marks (Mid-End-Total) (40-60-100)**

Course Objectives

- To provide basic concepts, behaviour and design of various reinforced concrete structures
- To introduce IS code provisions of reinforced concrete design and reinforced detailing
- To introduce ductility requirement of design and detailing
- To introduce yield line analysis of slabs and pre-stressed concrete

Course Learning Outcome

- Students will have the understanding of basic concepts, behaviour and design of various reinforced concrete structures
- Students will be conversant with various IS code provisions of reinforced concrete design and reinforced detailing
- Students can assess the ductility requirement of design and detailing
- Students will be well aware about yield line analysis of slabs and prestressed concrete

Course Description

Unit-I

Introduction, Design Concepts, Design Methods, Characteristic strength and load; Reinforcement Concrete Materials; Cement, Aggregates, Water, Admixture, Pozzolana, Concrete, Plastic Concrete, Hardened Concrete, Concrete Mix Design; Design of reinforced concrete structural elements under–Flexure, Shear, Torsion, and Bond; Serviceability requirements

Unit-II

Design of slabs; One way slab, Two way slab, Flat slab and Waffle slab; Yield Line Analysis of slab

Unit-III

Design of Columns; Design of Column section under axial load, axial load and uni-axial

moment, axial load and bi-axial moments; Design of short and slender column elements;

Ductile reinforcement detailing of column
Unit-IV
Prestressed concrete and design of prestressed concrete structural elements

Text Books
• RCC Design, S.N. Sinha, Tata MacGraw Hill • Design of RCC, Pillai and Menon, Tata MacGraw Hill • Design of Prestressed Concrete, Krishna Raju, Tata MacGraw Hill

Reference Books
IS Codes: • IS 456: 2002 • SP:16 and SP:32 • IS 13920: 1993

Software or other Requirement
• ETAB • SAP • ANSYS