K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ENGINEERING AND TECHNOLOGY

Bachelor of Technology (Civil Engineering)

Programme Code: 05

2019-23

Approved in the 20th Meeting of Academic Council Held on 16 July 2019

Academic Council
Member Secretary
K.R. Mangalam University

Registrar
K.R. Mangalam University
Sohna Road, Gurugram..(Haryana)

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About K.R Mangalam University

The K.R. Mangalam Group has made a name for itself in the field of education. The K.R. Mangalam story goes back to the chain of schools that offered an alternative option of world-class education, pitching itself against the established elite schools, which had enjoyed a position of monopoly till then. Having blazed a new trail in school education, the focus of the group was aimed at higher education.

K.R. Mangalam University is the fastest-growing higher education institute in Gurugram, India. K. R. Mangalam University was established under the Haryana Private University Act 2006, received the approval of Haryana Legislature vide Amendment Act # 36 of 2013 and consent of the Hon'ble Governor of Haryana on 11th April 2013, which was published in the Gazette notification vide Leg. No.10/2013, dated 3rd May 2013.

Since its inception in 2013, the University has been striving to fulfill its prime objective of transforming young lives through ground-breaking pedagogy, global collaborations, and world-class infrastructure. Resources at K.R Mangalam University have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly interdisciplinary environment where they grow up with integrative skills through interaction with students from engineering, social sciences, management and other study streams.

K.R Mangalam University is unique because of its:

1. Enduring legacy of providing education to high achievers who demonstrate leadership in diverse fields.
2. Protective and nurturing environment for teaching, research, creativity, scholarship, social and economic justice.

Objectives

i. To impart undergraduate, post graduate and doctoral education in identified areas of higher education.
ii. To undertake research programmes with industrial interface.
iii. To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programmes with foreign, Indian Universities/Institutions and MNCs.
iv. To act as a nodal center for transfer of technology to the industry.
v. To provide job oriented professional education to the Indian student community with particular focus on Haryana.

About School of Engineering & Technology (SOET)

School of Engineering and Technology (SOET), K.R. Mangalam University is dedicated to fostering innovation, excellence, and advancement in engineering and technology. Empowering the new generation of change-makers by imparting exceptional understanding and intellect to facilitate the creation of highly sophisticated futuristic solutions. Our well-qualified academicians, accomplished researchers and industry insiders are focused on imparting their extensive knowledge and expertise to students through various lectures, workshops, industrial visits, projects, and competitions throughout the year ensuring that students receive a comprehensive education that blends theory with practical application.

These programs offered at SOET have the distinct objective of equipping the students with knowledge, skills and attitudes in engineering and technology, to make them capable of successfully meeting the present requirements and future challenges in the engineering profession. SOET brings together outstanding academics, industry professionals, and experienced researchers to deliver a unique hands-on and multi-disciplinary learning experience.

The curriculum of programs has been designed to cater to the ever changing needs and demands of the industry. The curriculum is regularly updated. The school has best infrastructure including domain-specific labs. SOET aims to provide exposure to the principles and practices of Design / Developments and Projects in the area of engineering. SOET is offering Ph.D. programs also.

School Vision

To create, disseminate, and apply knowledge in science and technology to meet the higher education needs of India and the global society, To serve as an institutional model of excellence in scientific and technical education characterized by integration of teaching, research and innovation.

School Mission

M1: To create an environment where teaching and learning are prioritized, with all support activities being held accountable for their success.

M2: To strengthen the institution's position as the school of choice for students across the State & Nation.

M3: To promote creative, immersive, and lifelong learning skills while addressing societal concerns.

M4: To promote co- and extra-curricular activities for overall personality development of the students.

M5: To promote and undertake all-inclusive research and development activities.

M6: To instill in learners an entrepreneurial mindset and principles.

M7: Enhance industrial, institutional, national, and international partnerships for symbiotic relationships.

M8: To help students acquire and develop knowledge, skills and leadership qualities of the 21st Century and beyond.

Programmes offered by the School

School offers undergraduate B. Tech Program, B.Sc. (Hons) Program, postgraduate M. Tech Program, and Doctoral Program. All these programs are designed to impart scientific knowledge to the students and provide theoretical and practical training in their respective fields.

B. Tech in Civil Engineering

Eligibility Criteria: The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science with mathematics as one of the subjects and with an overall aggregate of 50% or more.

Course Outline: Surveying, Structural Analysis, Design of Concrete Structures, Design of Steel Structures, Concrete and Construction Technology, Building Material, Environmental Engineering, Transportation Engineering, Water Resource Engineering, Fluid Mechanics, Hydraulics, Estimation and Costing, Railway Engineering, Airport and Harbor Engineering, Geotechnical Engineering and Soil Mechanics.

Career Options: AII the major Infrastructure Developers like Hindustan Construction Company (HCC), DLF, Larsen and Toubro etc; Railways, Public Sector Undertakings including Indian Oil Corporation (IOCL), Bharat Sanchar Nigam Limited (BSNL), Gas Authority of India Limited (GAIL), Steel Authority of India Limited(SAIL), Indian Space Research Organisation (ISRO), National Thermal Power Corporation Limited (NTPC), Bharat Heavy Electricals Limited (BHEL), Oil and Natural Gas Corporation Limited(ONGC), Hindustan Aeronautics Limited(HAL), CPWD, PWDs, Environmental Agencies/ Industry, Defense & Civil Services, etc.

Program Duration: 4 Years

The maximum period for the completion of the B.Tech. (ME) Programme offered by the University shall be four years.

Class Timings

The classes will be held from Monday to Friday from 9.10 am to 4.00pm.

Scheme of Studies and Syllabi

The scheme of studies and syllabi of B. Tech (CE) is given in the following pages. These are arranged as (a) common courses (b) degree-specific courses, in numeric order of the last three digits of the course code. The first line contains; Course Code and Credits (C) of the course for each course. This is followed by detailed syllabi.

Four Year B. Tech (Civil Engineering) Programme at a Glance

Semester	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Courses	9	10	10	11	9	8	10	5	72
Credits	26	26	27	28	23	23	23	21	197

Scheme of Studies as per Choice Based Credit System (CBCS)

S. No.	**Category**	**Subject Code**	**Title**	**L**	**T**	**P**	**C**
1	SE	ETCS103A	PROGRAMMING FOR PROBLEM SOLVING	3	1	0	4
2	SE	ETMA105A	APPLIED MATHEMATICS-I	3	1	0	4
3	SE	ETCH125A	ENVIRONMENTAL STUDIES	3	0	0	3
4	SE	ETPH 109A	ENGINEERING PHYSICS	3	1	0	4
5	SE	ETME101A	BASICS OF MECHANICAL ENGINEERING	3	1	0	4
6	SE		OPEN ELECTIVE-I	-	-	-	4
7	SE	ETPH151A	ENGINEERING PHYSICS LAB	0	0	2	1
8	SE	ETCS153A	PROGRAMMING FOR PROBLEM SOLVING LAB	0	0	2	1
9	SE	ETME151A	BASICS OF MECHANICAL ENGINEERING LAB	0	0	2	1
				15	**4**	**6**	**26**

S. No.	Category	Subject Code	Title	L	T	P	C
1	SE	ETMA104A	APPLIED MATHEMATICS-II	3	1	0	4
2	SE	ETEC101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	1	0	4
3	SE	ETCS112A	OBJECT ORIENTED PROGRAMMING	3	1	0	4
4	SE	ETEL101A	COMMUNICATION SKILLS	4	0	0	4
5	SE		OPEN ELECTIVE - II	-	-	-	4
6	SE	ETME155A	ENGINEERING GRAPHICS LAB	0	0	3	1.5
7	SE	ETEC151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	0	0	2	1
8	SE	ETCS166A	OBJECT ORIENTED PROGRAMMING LAB	0	0	2	1
9	SE	ETEL171A	COMMUNICATION SKILLS LAB	0	0	2	1
10	SE	ETME157A	WORKSHOP PRACTICE	0	0	3	1.5
				13	**3**	**12**	**26**

S. No.	Category	Subject Code	Title	L	T	P	C
1	SE	ETMA 201A	Applied Mathematics-III	3	1	0	4
2	CC	ETCE 211A	Structural Analysis-I	3	1	0	4
3	CC	ETCE 213A	Surveying-I	3	1	0	4
4	CC	ETCE 207A	Building Materials & Technology	3	0	0	4
5	CC	ETCE 217A	Fluid Mechanics	3	1	0	4
6	SE	ETCE 264A	Disaster Preparedness and Planning	3	0	0	3
7	SE	ETCE 261A	Surveying-I Lab	0	0	2	1
8	SE	ETME 255A	Fluid Mechanics Lab	0	0	2	1
9	SE	ETCE 257A	Structural Analysis-I Lab	0	0	2	1
10	SE	ETCE 260A	Building Drawing Lab.	0	0	2	1
				18	**4**	**8**	**27**

S. No.	Category	Subject Code	Title	L	T	P	C
1	CC	ETCE 214A	Surveying & Geomatics	3	1	0	4
2	CC	ETCE 206A	Construction & Concrete Technology	3	0	0	4
3	CC	ETCE 204A	Soil Mechanics	3	1	0	4
4	CC	ETCE 321A	Project Plannning and Management	3	0	0	3
5	CC	ETCE 317A	Structural Analysis-II	3	1	0	4
6	CC	ETCE 216A	Fluid Machines	3	1	0	4
7	SE	ETCE 255A	Fluid Machines Lab	0	0	2	1
8	SE	ETCE 256A	Construction & Concrete Technology Lab	0	0	2	1
9	SE	ETCE 258A	Structural Analysis-II Lab	0	0	2	1
10	SE	ETCE 262A	Surveying Lab	0	0	2	1
11	SE	ETCE 254A	Soil Mechanics Lab	0	0	2	1
				18	**4**	**10**	**28**

S. No.	Category	Subject Code	Title	L	T	P	C
1	CC	ETCE 401A	Hydrology	3	0	0	3
2	CC	ETCE 301A	Estimation & Costing	3	1	0	4
3	CC	ETCE 307A	Design of Concrete Structures–I	3	1	0	4
4	CC	ETCE 321A	Environmental Engineering -I	3	1	0	4
5	CC	ETCE 313A	Engineering Geology and Rock Mechanics	3	0	0	3
6	SE	ETCE 357A	Engineering Geology Lab	0	0	2	1
7	SE	ETCE 354A	Environmental Engineering Lab-I	0	0	2	1
8	SE	ETCE 358A	Survey Camp	0	0	4	2
9	SE	ETCE 381A	Practical Training- I	0	0	2	1
				15	**3**	**10**	**23**

S. No.	Category	Subject Code	Title	L	T	P	C
1	CC	ETCE 302A	Design of Concrete Structures-II	3	1	0	4
2	CC	ETCE 364A	Irrigation Engineering	3	1	0	4
3	CC	ETCE 303A	Geotechnical Engineering	3	1	0	4
4	CC	ETCE 322A	Environmental Engineering-II	3	1	0	4
5	CC	ETCE 316A	Transportation Engineering-I	3	1	0	4
6	SE	ETCE 459A	Cad Lab	0	0	2	1
7	SE	ETCE 351A	Geotechnical Engineering Lab	0	0	2	1
8	SE	ETCE362 A	Transportation Engineering-I Lab	0	0	2	1
				15	**5**	**6**	**23**

S. No.	Category	Subject Code	Title	L	T	P	C
1	CC	ETCE 310A	Foundation Engineering	3	0	0	3
2	CC	ETCE 403A	Design of Steel Structure–I	3	1	0	4
3	SE/CC		Departmental Elective	3	1	0	4
4	CC	ETCE 308A	Transportation Engineering-II	3	1	0	4
5	CC	ETCE 411A	Bridge Engineering	3	0	0	3
6	SE	ETCE 356A	Foundation Engineering Lab	0	0	2	1
7	SE	ETCE 352A	Transportation Engineering-II Lab	0	0	2	1
8	SE	ETCE 455A	Minor Project	0	0	4	2
9	SE	ETCE 481A	Practical Training II	0	0	2	1
10	SE		Value added courses	2	0	0	0
				18	**6**	**4**	**30**

S. No.	**Category**	**Subject Code**	**Title**	**L**	**T**	**P**	**C**
1	CC	ETCE 404A	Earthquake Resistant Design	3	0	0	3
2	SE/CC		Departmental Elective	3	1	0	4
3	CC	ETCE 408A	Design of Steel Structure-II	3	1	0	4
4	SE/CC		Departmental Elective	3	1	0	4
5	SE	ETCE 452A	Major Project	0	0	12	6
				12	**3**	**12**	**21**
				197			

Abbreviations:

CC: Core Course

SE: Skill Enhancement

OE: Open Elective

SEMESTER - I

ETCS103A	PROGRAMMING FOR PROBLEM SOLVING	C
		4

Overview:

Computer software plays an important role in our daily lives: Our mobile phones, laptop computers, online banking, Internet applications such as YouTube, video games and movies, cars, and almost all aspects of daily life are touched by software. In your personal and professional life, you will utilize computer software. It is also likely that you will select, or even influence the design of, software that is used in your professional or personal life. This thematic sequence will give you a deep understanding of how software works and is created, its limitations, and its potential. You will be able to read software and therefore be able to make informed decisions when selecting or participating in the design of business, scientific, or information systems that utilize computer software. This is a course in which you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems.

Objectives and Expected Outcomes:

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

ETCS103 A	PROGRAMMING FOR PROBLEM SOLVING	L	T	P	C
		3	1	0	4

UNIT I

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:
Flowchart / Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- Arithmetic expressions and precedence

UNIT II

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops. Arrays: Arrays (1-D, 2-D), Character arrays and Strings

UNIT III

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)
Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.
Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function, Quick sort or Merge sort.

UNIT IV

Structure**:** Structures, Defining structures and Array of Structures

Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Suggested Text Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

ETCH 125A	ENVIRONMENTAL STUDIES	C
		3

Overview:

Everything that surrounds and affects living organisms is environment. Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living or biotic components like animals, plants or non-living or abiotic components like soil, air and water etc. It belongs to all, influences all and is important to all.

Environmental Protection Act (1986) defined "Environment as the sum total of water, air and land, their interrelationship among themselves and with the human beings, other living organisms and materials." Environmental studies are important since it deals with the most mundane problems of life like hygienic living conditions, safe and clean drinking water, fresh air, healthy food and sustainable development.

The syllabus for Environmental Studies includes conventional classroom teaching as well as field work. In this course the teacher simply acts as a catalyst to infer what the student observes or discovers in his/her own environment. Involvement of students in project work is one of the most effective learning tools for environmental issues. This syllabus is beyond the scope of textbook teaching and also the realm of real learning by observing the surroundings. The content of this course provides an overview of introduction to environment, concept of an ecosystem, various renewable and non-renewable resources, how various biodiversity occur and different means to conserve these. This course also includes various types of pollution and environmental policies & practices related with environs. Finally, it also highlights the relationship of human population with environment. The course further integrates to project work such as visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds, and study of simple ecosystems. These studies are as imperative as it forms a unique synergistic tool for comprehensive learning process. This will help students to recognize and appreciate how the technological advancement at global level, exponential growth of human population and their unlimited demands has put the environment at stake and has contaminated the environment worldwide.

Objective and expected Outcome:

The main objective of the course is to create consciousness among the students with the idea about healthy and safe environment. This course is aimed to explain students that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels. These changes need the discussion, concern and recognition at national and international level with respect to formulate protection acts and sustainable developments policies. It can be possible only if every citizen of the nation is environmentally educated and gets involved into this matter at the grass root level to mitigate pollution.

After studying the course, the learners will be able to comprehend and become responsive regarding environmental issues. They will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain. This is the only inheritance which every genera of specie passes to their future generation.

ETCH 125A	ENVIRONMENTAL STUDIES	L	T	P	C
		3	-	-	3

Course Objectives: This course in environmental studies will develop the:

- Basic understanding about the concept related to environment such as eco system and biodiversity.
- Insight about the various concerns regarding environment such as population and social issues.

UNIT I

Introduction of Environmental Studies: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.

Natural Resources: Renewable and Non-renewable Resources

Land resources: land use change; Land degradation, soil erosion and desertification**.**

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II

Ecosystems: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological Diversity: Levels of biological diversity; genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III

Environmental Pollution: Types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Environmental Policies and practices: Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.

Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. International agreements: Montreal & Koyoto protocol and convention on biological diversity. Nature reserves, tribal population and rights, human wild life conflicts in Indian context.

UNIT IV

Human Communities and the Environment: Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides;

Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g. CNG vehicles in Delhi).

Field work:

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
Study of common plants, insects, birds and basic principles of identification.
Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books:

1. Erach Bharucha, Textbook of Environmental Studies, Universities Press (P) Ltd., Hyderabad, India.
2. Anubha Kaushik and C. P. Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books:

1. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
2. P. H. Raven, D. M. Hassenzahl & L. R. Berg, Environment, John Wiley & Sons, New Delhi.
3. J. S. Singh, S. P. Singh and S. R. Gupta, Ecology, Environmental Science and Conservation, S. Chand Publication, New Delhi.

ETMA105 A	APPLIED MATHEMATICS - I	C 4

Overview:

This course shows the modelling process in the context of matrix, and differential calculus, from a number of areas such as, economics, electric circuits, mechanical systems, fluid flow, and physics. Analytic methods from the elementary theory of differential equations and calculus will be provided to allow for the analysis of the various models being investigated.

Topics to be covered include: Matrices and their types: Elementary transformation**,** Inverse of matrix by elementary operations, Rank, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalization of a matrix.

Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor's and Maclaurin's theorem and expansion of functions, Asymptotes (Cartesian and polar),Curve Tracing, Curvature, Radius of Curvature, Maxima and Minima.

Partial Differentiation: Partial differentiation, Euler's theorem on homogeneous functions, Composite functions, Jacobians, Taylor's theorem of two variables and its application to approximate errors, Maxima-Minima for two variables, Lagrange's method of undermined multipliers.

Multiple Integration: Beta and Gamma integrals, Differentiation under integral sign, Double and Triple integrals computation of surface areas and volumes, change of variables in double and triple integrals.

Objectives and expected outcomes:

Upon successful completion, students will have the knowledge and skills to:

Explain the fundamental concepts of matrix and differential calculus and their role in modern applied mathematics and real-world contexts.

Demonstrate accurate and efficient use of techniques involved in solving partial differentiation.

Apply problem-solving using techniques in differential calculus in diverse situations in physics, engineering and other mathematical contexts.

Student will able to solve improper integrals and evaluate multiple integrals in various coordinate systems.

ETMA105A	APPLIED MATHEMATICS - I	L	T	P	C
		3	1	-	4

Course Objective: Knowledge of Mathematics is essential for proper understanding of all the engineering and Science subjects. Through this course it is intended to make the students in various disciplines get acquainted with basic concepts of different topics from Mathematics, which is needed to pursue their engineering degree in different disciplines.

UNIT I

Matrices and its application: Elementary transformation**,** Inverse of matrix by elementary operations, **Rank**, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalization of a matrix.

UNIT II

Application of Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor's and Maclaurin's theorem and expansion of functions, Asymptotes (Cartesian and polar),Curve Tracing, Curvature, Radius of Curvature.

UNIT III

Calculus of several Variables: Partial differentiation, Euler's theorem on homogeneous functions, Composite functions,Jacobians, Taylor's theorem of two variables and its application to approximate errors, Maxima-Minima for two variables, Lagrange's method of undermined multipliers.

UNIT IV

Multiple Integration: Beta and Gamma integrals, Differentiation under integral sign,Double and Triple integrals computation of surface areas and volumes,change of variables in double and triple integrals

TEXT BOOKS:

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication.

REFERENCES BOOKS:

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

ETME 101A	BASICS OF MECHANICAL ENGINEERING	C
		4

Overview:

This is one of the core subjects that introduces the student to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc.

Course Objectives:

The subject expects students to achieve the following objectives.

- To analyse, design and improve practical thermal and/or mechanical systems.
- To give students practice in applying their knowledge of mathematics, science, and engineering and to expand this knowledge into the vast area of mechanical engineering.
- To enhance students' ability to design by requiring the solution of open-ended problems.
- To prepare the students for higher level courses such as courses in Mechanics of Solids, Thermodynamics, Manufacturing, etc.

Course Outcomes:

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

- Know the basics of machine tool and their material properties.
- Understand the basic concepts of thermodynamics and Refrigeration.
- Get the knowledge of application of hydraulic turbines and pumps in various fields.
- Know various Power Transmission Methods and Devices.
- Understand the concept of Stress & Strain which is useful in various streams of engineering.

ETME 101A	BASICS OF MECHANICAL ENGINEERING	L	T	P	C
		4	0	0	4

Course Objective: This is one of the core subjects that introduces the student to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines.

Unit I

Introduction to Machine Tools and Commonly used Machine Tools in a Workshop: Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting.

Basic concept of thermodynamics: Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2^{nd} and 3^{rd} law of thermodynamics, Concept of internal energy, enthalpy and entropy. Problems Properties of Steam & Steam Generator Formation of steam at constant pressure, Thermodynamic properties of Steam, Use of steam tables, Measurement of dryness fraction by throttling calorimeter.

Unit II

Refrigeration & Air-conditioning: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapor compression cycle, Psychrometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

Unit III

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches

Stresses and Strains: Introduction, Concept & types of Stresses and strains, Poison's ratio, stresses and strains in simple and compound bars under axial, flexure & torsional loading, Stress- strain diagrams, Hooks law, Elastic constants & their relationships.

Unit IV

Introduction to Manufacturing Systems: Fundamentals of Numerical Control (NC), Advantage of NC systems, Classifications of NC, Comparison of NC and CNC

Text Books:

1. Elements of Mechanical Engineering – R.K.Rajput Lakmi Pub., Delhi
2. Elements of Mechanical Engineering – D.S.Kumar, S.K. Kataria and Sons
3. Engineering Thermodynamics- P.K.Nag TMH, New Delhi
4. Refrigeration & Air-conditioning – Arora & Domkundwar, Dhanpat rai & co.pvt ltd
5. Workshop Technology Vol.I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
6. Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi.

Reference Books:

1. Strength of Materials – Popov, Pub. PHI, New Delhi.
2. Hydraulic Machines – Jagdish Lal, Pub. Metropolitan, Allahabad.
3. Strength of Materials - G.H. Ryder, Pub. ELBS.

OPEN ELECTIVE- I	C 6

There are three open electives offered by other departments / schools in first semester. The department will permit student to opt one open elective based on choice of student and consent of the course advisor.

S.No.	Course Code	Course Title
1	IIIT101	Harnessing the Power of the Web as a Knowledge Device
2	IIIT107	Art of Logic & Programming
3	ETCE101	Fundamentals of Civil Engineering

ETPH109A	ENGINEERING PHYSICS	C
		4

Overview

Oscillations play an important role in the macro- and micro-world. Oscillation cannot be just mechanical. So, for instance, one can consider the oscillations of an electric current in an oscillatory circuit or a magnetic field strength in a dynamo, etc. These can be described by an equation similar to the one that defines mechanical displacements from a position of equilibrium. In spite of this fact, mechanical oscillations are mostly analyzed, keeping in mind their applicability to other types of oscillation. Oscillations originating from any source propagate further in space. The propagating oscillations are referred to as waves. Different waves exist, such as mechanical, electromagnetic, and acoustic, depending on what physical value is propagated. Mechanical waves can propagate only in an elastic media. If particle vibrations are agitated in a region of an elastic medium (solid, liquid or gaseous), as a consequence of the interaction among particles, this disturbance is transmitted to surrounding particles, which in turn, distributes excitation further. In this manner, the wave appears.

The physics and mathematics of wave motion underlies many important phenomena. The water wave on the sea, the vibration of a violin string, and the quantum mechanical wave associated with an electron can all be described in a similar way. Light too, often displays properties that are wave-like. We will start the course looking at "ray" optics, but then pause for a general treatment of waves of all types. We will start this waves section by reviewing ideas of oscillations and simple harmonic motion and go on to look at the physics of travelling and standing waves i.e. wave motion. We will apply these ideas to various types of wave and see how all-pervading this topic is in physics.

Optics is the study of light and its uses. Light has long captured the fascination of humankind like Why should light bend upon entering water? Why does light spread out after passing through a narrow gap? How does light travel to us from the sun, through the void of space? These sorts of questions have ensured that optics has a long and engaging history. So,in this lecture course we will look at basic ideas of light propagation, interference and diffraction of light, Polarization, and some of the many uses to which light is put.

Objective and Expected Outcome:

The main objective of this subject is to aware the students about various phenomenon of oscillation, waves and optics. This course first deal with the simple harmonic motion, damped and forced simple harmonic oscillator. It deals with the Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion. This course also deals with the propagation of light and geometric optics, wave optics and lasers.

After the completion of the course, Students will be able to understand the physics behind various phenomenon's in oscillation, waves and optics. Students can understand various phenomenon and the cause or origin of them. They also can understand the physics behind various optical phenomenon's and various natural phenomenon which is happening in their surroundings.

ETPH109A	ENGINEERING PHYSICS	L	T	P	C
		4	0	0	4

Unit-I

Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators,damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor.

Unit-II

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary. Longitudinal waves and the wave equation for them, acoustics waves and speed of sound, wave groups and group velocity.

Unit-III

The propagation of light and geometric optics

Laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection,

Wave optics

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Farunhofer

diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Unit-
IV

Lasers

Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

(i) Ian G. Main, Oscillations and waves in physics

(ii) H.J. Pain, The physics of vibrations and waves

(iii)E. Hecht, Optics

(iv) A. Ghatak, Optics

(v) O. Svelto, Principles of Lasers

ETPH151A	ENGINEERING PHYSICS LAB	C
		1

Overview:

This course gives an experimental understanding of the different phenomena of oscillation, waves and optics which students have encountered in theory course. Without experimental understanding it is very difficult to realize the theoretical concepts. This course contains experiments of oscillation, waves and optics.

Objective and Expected Outcome:

The objective of this course is to make students more familiar with the concepts of various phenomenon of oscillation, waves and optics through hands on experience. After this course students can gain knowledge about how we can find the value of acceleration due to gravity, wave length of a give source of light, refractive index of material of a given prism and specific rotation by the concept of polarization of light.

ETPH151A	ENGINEERING PHYSICS LAB	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1) To determine the value of acceleration due to gravity using Bar pendulum.
2) To determine the value of acceleration due to gravity using Kater's pendulum.
3) To determine the wavelength of sodium light using Newton`s ring apparatus.
4) To determine the wavelength of prominent lines of mercury by plane diffraction grating.
5) To determine the refractive index of the material of the prism for the given colours(wavelengths) of mercury light with the help of spectrometer.
6) To determine the specific rotation of cane sugar solution with the help of half shadepolarimeter.
7) To determine the wavelength of He-Ne LASER using transmission diffraction grating.

Suggested Reference Books

- C. L.Arora, B.Sc Practical Physics (S Chand and Co. Ltd., New Delhi).
- Harnam Singh, Hemne P S, B.Sc.Practical Physics (S. Chand & Co).
- Indu Prakash, Ramakrishna, A Text Book of Practical Physics (Kitab Mahal, New Delhi).

ETME 151A	BASICS OF MECHANICAL	C

	ENGINEERING LAB	**1**

Overview:

This is one of the core lab subjects that introduces the student to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc. through practical exposure.

Course Objectives:

- To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start & Double Start Worm & Worm Wheel, Differential Wheel & Axle.
- To study simple screw jack and compound screw jack and determine their efficiency.
- To verify the law of Moments using Parallel Force apparatus. (simply supported type)
- To evaluate the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
- To Study Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
- To Study the vapor compression Refrigeration System and Window Room Air Conditioner.
- To study the constructional features and working of Pelton wheel Turbine, Francis Turbine and Kaplan Turbine, etc.

Course Outcomes:

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

- Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.
- Understand concepts of screw jack, friction, law of moments.
- Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
- Get the knowledge of various Refrigeration and Air- Conditioning Systems.
- Know about the working of various turbines and pumps.

ETME 151A	**BASICS OF MECHANICAL ENGINEERING LAB**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

List of Experiments

- To verify the law of Force Polygon
- To verify the law of Moments using Parallel Force apparatus. (simply supported type)
- To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
- To find the forces in the members of Jib Crane.
- To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.
- To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle
- To verify the law of moments using Bell crank lever.
- To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.
- To Study Two-Stroke & Four-Stroke Diesel Engines.
- To Study Two-Stroke & Four-Stroke Petrol Engines.
- To Study the vapor compression Refrigeration System.

ETCS153A	**PROGRAMMING FOR PROBLEM SOLVING LAB**	**C** **1**

Overview:

This course emphasizes solving problems using the language, and introduces standard programming techniques like alternation, iteration and recursion. It will briefly glimpse the basics of software engineering practices like modularization, commenting, and naming conventions which help in collaborating and programming in teams. This course is enabled the students to formulate algorithms for arithmetic and logical problems, convert these

algorithms to C language programs. It also aims on using arrays, pointers and structures to formulate algorithms and programs. In addition to that, apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Objectives and Expected Outcomes:

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

- To understand the various steps in program development
- To learn the syntax and semantics of C programming language
- To use the structural programming approach in solving the problem.

ETCS153A	PROGRAMMING FOR PROBLEM SOLVING LAB	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

Lab1: Familiarization with programming environment
Lab 2: Simple computational problems using arithmetic expressions
Lab 3: Problems involving if-then-else structures

Lab 4: Iterative problems e.g., sum of series
Lab 5: 1D Array manipulation
Lab 6: Matrix problems, String operations
Lab 7: Simple functions
Lab 8 and 9: Programming for solving Numerical methods problems
Lab 10: Recursive functions
Lab 11: Pointers and structures
Lab 12: File operations.

SEMESTER – II

ETCS112A	OBJECT ORIENTED PROGRAMMING	C
		4

Overview:

This course introduces the concepts of object-oriented programming to students with a background in the procedural paradigm. The course begins with a brief review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. Other topics include an overview of programming language principles, simple analysis of algorithms, basic searching and sorting techniques, event-driven programming, memory management and an introduction to software engineering issues.

Objectives and Expected Outcomes:

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

- Explain the steps in creating an executable program for a computer, including the intermediate representations and their purpose
- Manipulate binary patterns and understand the use of binary to represent numbers.
- Apply good programming style and understand the impact of style on developing and maintaining programs
- Effectively use a version control system and the Linux command line tools for incremental development.
- Explain the benefits of object-oriented design and understand when it is an appropriate methodology to use.
- Design object-oriented solutions for small systems involving multiple objects. Identify the relative merits of different algorithmic designs.

ETCS 112A	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		2	1	-	3

Course Objective: The objective of the course module is to acquaint students with object-oriented programming using Programming C++.

UNIT I

Introduction: Introducing Object-Oriented Approach related to other paradigms (functional, data decomposition), Characteristics of Object-Oriented Languages.

Basic terms and ideas: Abstraction, Encapsulation, Information hiding, Inheritance, Polymorphism, Review of C, Difference between C and C++, Cin, Cout, new, delete operators.

UNIT II

Classes and Objects: Abstract data types, Object & classes, attributes, methods, C++ class declaration, State identity and behavior of an object, Constructors and destructors, instantiation of objects, Default parameter value, Copy Constructor, Static Class Data, Constant and Classes, C++ garbage collection, dynamic memory allocation.

UNIT III

Inheritance and Polymorphism: Inheritance, Types of Inheritance, Class hierarchy, derivation – public, private & protected, Agrégations, composition vs classification hiérarchies, Polymorphism, Type of Polymorphism – Compile time and runtime, Method polymorphism, Polymorphism by parameter, Operator overloading, Parametric polymorphism, Generic function – template function, function name overloading, Overriding inheritance methods

UNIT IV

Files and Exception Handling: Persistent objects, Streams and files, Namespaces, Exception handling, Generic Classes

Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterates, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

TEXT BOOKS:

1. A.R. Venugopal, Ra jkumar, T. Ravishanker "Mastering C++", TMH
2. R. Lafore, "Object Oriented Programming using C++", BPB Publications
3. Schildt Herbert, "C++ Programming", 2nd Edition, Wiley DreamTech.

REFERENCE BOOKS:

1. D. Parasons, "Object Oriented Programming with C++", BPB Publication
2. Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication
3. Yashwant Kanethkar, "Object Oriented Programming using C++", BPB

ETEC101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	C
		4

Course Overview:

The course is designed to gain the essential knowledge about electrical circuit elements, DC circuits, AC circuits, magnetism, transformers and electrical machines. The undergraduates are familiarized with the basics of installations required for the protection and wiring. The fundamentals of power converters are part of the course.

Learning objectives:

- To understand the circuit behavior on the DC supply
- To analyze the complex circuits using various theorems to resolve it to a simple circuit.
- To understand the circuit behavior on the AC supply
- Analysis of single-phase ac circuits consisting of combinations (series and parallel) elements
- Working and application of transformer
- To analyze the behavior of electrical machines for the losses, efficiency and other parameters.
- To gain basic insight of inverters and boost converters.
- To get acquainted with components of low voltage switchgear.

Expected Outcome:

- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

ETEC101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	L	T	P	C
		3	1	-	4

UNIT I

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

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UNIT II

A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation,Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component

Unit III

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents.

P-N junction diode : Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation.

Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.

Unit IV

Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates

Bipolar junction transistor: Introduction to transistors: construction,transistor operations, BJT characteristics, load line, operating point, leakage currents.

Application of BJT:CB, CE configurations,Introduction to FETs and MOSFETs.

TEXT BOOKS:

1. D.P. Kothari & I J Nagrath , Basic Electrical Engineering , Tata McGraw Hill , New Delhi.
2. B L Thareja – A text book of Electrical Technology
3. Boylestad&Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10th Edition.
4. V. K. Mehta &Rohit Mehta, "Principles of Electronics", S. Chand Publishers, 27th Edition.

REFERENCE BOOKS:

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.
4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.
5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai & Sons.

ETMA104 A	APPLIED MATHEMATICS - II	C 4

Overview:

The construction of mathematical models to address real-world problems has been one of the most important aspects of each of the branches of engineering and technology. This course is an introduction to Laplace Transformation, vector calculus, ordinary differential equations andPartial Differential Equations.

Topics includes:

Laplace Transformation: Existence condition, Laplace transform of standard functions,

Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.
Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).
Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.
Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

Objectives and expected outcomes:

Upon successful completion, students will have the knowledge and skills to:

- Concepts & properties of Laplace Transforms
- Solving differential equations using Laplace transform techniques
- Determine the solution of a PDE by variable separable method
- Analyze real world scenarios to recognize when ordinary differential equations (ODEs) or systems of ODEs are appropriate, formulate problems about the scenarios,

creatively model these scenarios (using technology, if appropriate) in order to solve the problems using multiple approaches, judge if the results are reasonable, and then interpret and clearly communicate the results.

- Identify an ordinary differential equation and classify it by order or linearity
- Determine whether or not a unique solution to a first-order initial-value problem exists.

		4	**1**	**-**	**5**

Course Objective: Mathematics being mother of all sciences, knowledge of Mathematics is essential for a better understanding of almost all Engineering and Science subjects. Through this course module it is intended to make students well versed with the concept of basic topics from Mathematics to enable them pursue their Engineering degree in different disciplines.

UNITI

Laplace Transformation: Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.

UNIT II

Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).

UNIT III

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

UNIT IV

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

TEXT BOOKS:

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication.

REFERENCES BOOKS:

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

ETEL101A	**COMMUNICATION SKILLS**	**C**

		4

Overview:

The world is shrinking into a global village and therefore, communication skills in English have emerged as a major means of empowerment and human resource development. Many professionals fail to make an impact on the global market as they lack the required communicative competence. The course will augment comprehension skills, enhance vocabulary, and enable to acquire impressive writing skills, assist correspondence with others effectively, aid in understanding the non-verbal cues and enrich skills in spoken English through a variety of teaching techniques. The course will be instrumental in acquiring proficiency both in spoken and oral language.

Objectives and Expected Outcomes:

The course will help the learners to focus on communication activities in functional and situational contexts as well as enhance the four language skills of reading, writing, listening and speaking through real-life and professional situations. It will build confidence among the students and encourage them to speak fluently. Through practical learning and delivery, the learners will be able to identify their areas of strengths and weaknesses and improvise their personality and soft skills. The learners will be able to strengthen and broaden their communication skills through various insightful ways.

This learning program with its practice-based learning tasks will facilitate the learners to enhance their communication skills in a modern and globalized context, enhance their linguistic and communicative competence and hone their interpersonal skills.

ETEL 101A	COMMUNICATION SKILLS	L	T	P	C
		4	-	-	4

Course Objective: The purpose of this course is to

- Understand the basics of Grammar to improve communication and speak correct form of English
- Improve students' personality and enhance their self-confidence

UNIT I

Introduction to Communication: Meaning, Forms & Types of Communication; Process of Communication; Principles of Effective Communication/7Cs, Barriers in Communication

UNIT II

Essentials of Grammar: Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection; Using tenses; Articles; Reported Speech; Punctuation

UNIT III

Building Vocabulary: Word Formation (by adding suffixes and prefixes); Common Errors; Words Often Confused; Homonyms and Homophones; Antonyms/Synonyms, Phrasal Verbs

UNIT IV

Personality Development: Public Speaking; Body Language: Posture, Gesture, Eye Contact, Facial Expressions; Presentation Skills/ Techniques

Text Book:

1. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford University Press.

References Books:

1. M.L.Tickoo, A. E. Subramanian and P.R. Subramanian, Intermediate Grammar, Usage and Composition, Orient Blackswan.
2. Barun K Mitra, Personality Development and Soft Skills, Oxford University Press.

OPEN ELECTIVE - II	C 6

There are three open electives offered by other departments / schools in second semester. The department will permit student to opt one open elective based on choice of student and consent of the course advisor.

S.No.	Course Code	Course Title
1	IIIT104	Understanding The Power of Data
2	IIIT102	Fundamentals of Innovation and Entrepreneurship
3	ETCE12	URBAN Engineering

	BASICS OF ELECTRICAL &	C

ETEC151A	ELECTRONICS ENGINEERING LAB	1

Course Overview:

The course is designed to gain the essential knowledge about electrical circuit elements, DC circuits, AC circuits, magnetism, transformers and electrical machines. The undergraduates are familiarized with the basics of installations required for the protection and wiring. The fundamentals of power converters are part of the course.

Learning objectives:

- To understand the circuit behavior on the DC supply
- To analyze the complex circuits using various theorems to resolve it to a simple circuit.
- To understand the circuit behavior on the AC supply
- Analysis of single-phase ac circuits consisting of combinations(series and parallel) elements
- Working and application of transformer
- To analyze the behavior of electrical machines for the losses, efficiency and other parameters.
- To gain basic insight of inverters and boost converters.
- To get acquainted with components of low voltage switchgear

Laboratory Outcomes:

The students are expected to

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converter

ETCS166A	OBJECT ORIENTED PROGRAMMING LAB	C 1

Overview:

This course will give the learner an insight into how everything can be considered an

object and how simply we can write code to implement it. It helps us in making programming relatable to real world, as everything around us can be an object (having properties and functionality).

Object oriented programming aims to implement real world entities like inheritance, hiding, polymorphism etc. in programming. The main aim of OOP is to bind together he Data and the functions that operate on them so that no other parts of code and access this data accept that function.

Objective and Expected Outcome:

Students, who have already studied Structural programming like C, would understand how Object-oriented programming would help them in coding in a simpler and better way. For instance, a user of the program should only know what the input is and what is the output, he should not be concerned about the process. The programmer implements the concept through abstraction and information hiding, which are important features of object- oriented programming. During the course, students will learn to work in.

ETCS166A	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	C
		0	0	2	1

LIST OF EXPERIENTS

Q1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power ( ) that takes a double value for n and an into value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

Q2. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates.

Write a program that uses a structure called point to model a point. Define three points, and have

The user input values to two of them. Than set the third point equal to the sum of the other two,

And display the value of the new point. Interaction with the program might look like this: Enter coordinates for P1: 3 4
Enter coordinates for P2: 5 7
Coordinates of P1 + P2 are: 8, 11

Q 3. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this.

Enter first number, operator, second number: 10/ 3
Answer = 3.333333
Do another (Y/ N)? Y

Enter first number, operator, second number 12 + 100
Answer = 112
Do another (Y/ N) ? N

Q4. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

Enter your area code, exchange, and number: 415 555 1212
My number is (212) 767-8900
Your number is (415) 555-1212

Q 5. Create two classes DM and DB which store the value of distances. DM stores distances

in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB.

Use a friend function to carry out the addition operation. The object that stores the results maybe

a DM object or DB object, depending on the units in which the results are required.

The display should be in the format of feet and inches or meters and centimeters depending on

the object on display.

Q 6. Create a class rational which represents a numerical value by two double values- NUMERATOR & DENOMINATOR. Include the following public member Functions:

• constructor with no arguments (default).

• constructor with two arguments.

• void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.

• Overload + operator to add two rational number.

• Overload >> operator to enable input through cin.

• Overload << operator to enable output through cout.

Write a main ( ) to test all the functions in the class.

Q 7. Consider the following class definition

```
class father {
protected :int age;
public;
father (int x) {age = x;}
virtual void iam ( )
{ cout<< “I AM THE FATHER, my age is : ”<< age<< end1:}

};
```

Derive the two classes son and daughter from the above class and for each, define iam ( ) to write

our similar but appropriate messages. You should also define suitable constructors for these

classes.

Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them.

Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.

Q 8. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name (a string of 30 or lesser no. of characters) and marks.

Q9. A hospital wants to create a database regarding its indoor patients. The information to store include

a) Name of the patient

b) Date of admission

c) Disease

d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to

store the above information. The member function should include functions to enter information

and display a list of all the patients in the database. Create a derived class to store the age of the

patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

Q 10. Make a class **Employee** with a name and salary. Make a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **toString**that prints the manager's name, department and salary. Make a class **Executive** inherit from **Manager**. Supply a method **to String** that prints the string **"Executive"** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

Q11. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

Q12. Write a function called reversit ( ) that reverses a string (an array of char). Use for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise

ETME 155A	ENGINEERING GRAPHICS LAB	C
		1. 5

reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".

Q13. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach ( ) function and a user written display function. Then search the Deque for a particular string, using the first That ( ) function and display any strings that match. Finally remove all the items from the Deque using the getLeft ( ) function and display each item. Notice the order in which the items are displayed: Using getLeft ( ), those inserted on the left (head) of the Deque are removed in "last in first out" order while those put on the right side are removed in "first in first out" order. The opposite would be true if getRight ( ) were used.

Q 14. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data ( ) to initialize base class data Members and another member function display_area ( ) to compute and display the area of figures. Make display_area ( ) as a virtual function and redefine this function in the derived classes to suit their requirements.

Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:

Area of rectangle = x * y
Area of triangle = ½ * x * y

Overview:

This course covers the fundamentals of engineering graphics including the drawing of

orthographic, isometric, and auxiliary projections. Other topics include scaling, sectioning, dimensioning, and drawing documentation. This course uses the latest release of computer-aided design (CAD) software commonly used in industry to introduce students to CAD interface, structure, and commands.

Course Objectives:

The Basic aim of this subject is to: -

- Increase ability to communicate with people
- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic Auto Cad skills.
- Learn basic engineering drawing formats
- Prepare the student for future Engineering positions for designing

Course Outcomes:

After learning the course, the students should be able to: -

- To know and understand the conventions and the method of engineering drawing.
- Interpret engineering drawings using fundamental technical mathematics.
- Construct basic and intermediate geometry.
- To improve their visualization skills so that they can apply these skills in developing new products. To improve their technical communication skill in the form of communicative drawings.
- Comprehend the theory of projection

ETME 155A	ENGINEERING GRAPHICS LAB	L	T	P	C
		-	-	3	1.5

Course Objective: The Objective of this course is to acquaint engineering students regarding drawings, projections of planes, projection of solid and isometric projection of various objects.

UNIT I

General: Importance, Significance and scope of engineering drawing, Lettering,

Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications,

Projections of Point and Lines: Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

UNIT II

Planes other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

Projections of Plane Figures: Different cases of plane figures (of different shapes),making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes),Obtaining true shape of the plane figure by projection.

UNIT III

Projection of Solids: Simple cases when solid are placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

UNIT IV

Development and simple objects with and without sectioning

Isometric Projection:

Nomography: Basic Concepts and use.

TEXT BOOKS:

1. Engineering drawing by N.D.Bhatt (Charotar Publications).
2. Engineering drawing by M B Shah and B C Rana, Pearson Education 2007

REFERENCE BOOKS:

1. Engineering Drawing by S.C.Sharma&Navin Kumar (Galgotia Publications)
2. Engineering Drawing by Venugopalan.
3. Engineering Drawing by P.S.Gill

ETME 157A	WORKSHOP PRACTICES	C
		1.5

Overview:

Manufacturing is fundamental to the development of any engineering product. This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weightage, some lectures and video clips available on different methods of manufacturing are also included.

Course Objective:

- Understanding different manufacturing techniques and their relative advantages/ disadvantages with respect to different applications
- The selection of a suitable technique for meeting a specific fabrication need
- Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Outcomes:

- Introduction to different manufacturing methods in different fields of engineering
- Practical exposure to different fabrication techniques
- Creation of simple components using different materials
- Exposure to some of the advanced and latest manufacturing techniques being employed in the industry

ETME 157A	WORKSHOP PRACTICE	L	T	P	C
		-	-	3	1.5

UNIT I

Materials: Spectrography method for finding composition of materials.

Wood Working Shop: Making of various joints, Pattern making.

UNIT II

Foundary Shop: Bench moulding with single piece pattern and two piece pattern.Floor moulding - Making of bend pipe mould etc. Machine moulding - Making of mould using Match-plate pattern.Core making- Making and baking of dry sand cores for placing in horizontal, vertical and hanging positions in the mould cavity.

Fitting Shop: Learning use of fitting hand tools, marking tools, marking gauge. Exercises: Jobs made out of MS Flats, making saw - cut filling V-cut taper at the corners, circular cut, fitting square in square, triangle in square.

UNIT III

Welding Shop: Electric arc welding, Edge preparations, Exercises making of variousjoints.Bead formation in horizontal, vertical and overhead positions.

Gas Welding: Oxy-Acetylene welding and cutting of ferrous metals.

Soldering: Dip soldering.

Brazing: With Oxy-Acetylene gas.

UNITIV

Sheet Metal Shop: Learning use of sheet-metal tools, Exercises: Making jobs out of GI sheet metal. Cylindrical, Conical and Prismatic shapes. Project Shop: Extrusion of soft metals, Plastic coating of copper wires, Plastic.

ETMA201A	SEMESTER APPLIED MATHEMATICS - III	L	T	P	C
		-	-		4

Overview:

The construction of mathematical models to address real-world problems has been one of the most important aspects of each of the branches of engineering and technology. The first part of this module extends the theory of Fourier series and Fourier integral transform.
The second part of the module covers a complex variable which includes complex variable, analytic function, Cauchy-Riemann equations, and Residue theorem with their application.
Fourier series and its applications: Euler's formulae, Dirichlet's conditions, Change of interval, Fourier expansion of even and odd functions, Fourier expansion of square wave, Rectangular wave; Saw-toothed wave; Half & Full rectified wave functions, Harmonic analysis.
Fourier integrals and Transforms: Fourier integral theorem, Fourier sine integral, Fourier cosine integral, Fourier sine Transform, Fourier cosine transform, Fourier transform and its properties, Finite Fourier sine transform, Finite Fourier cosine transform, Fourier transforms of derivatives.
Functions of Complex Variables: Introduction to complex number, Limit, Continuity and Derivatives of complex functions, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Conformal mapping, Standard mappings (linear, square, inverse and bilinear), Complex line integral, Cauchy's integral theorem, Cauchy's integral formula, Zeroes and Singularities, Taylor series, Laurent's series, Calculation of residues, Residue theorem, Application of residue theorem to solve real integrals.

Objectives and expected outcomes:

Upon successful completion, students will have the knowledge and skills to:

1. Obtain the Fourier series and Fourier transform for a given function
2. Evaluate real integrals using residue theorem
3. Express analytic functions in terms of Taylor's series and Laurent series.
4. Calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem or residue calculus;
5. Express any periodic function in term of sines and cosines
6. Analyze one dimensional wave and heat equation.

ETMA 201A	APPLIED MATHEMATICS - III	L	T	P	C
		3	1	-	4

Course Objective: The objective of the course is to provide a brief knowledge of Applied Mathematics to the Engineering students. The students will learn about the Fourier series, Fourier transforms, Special functions, Partial differential equations and its engineering applications.

UNIT I

Fourier Series and its applications: Euler's formulae, Dirichlet's conditions, Change of interval, Fourier expansion of even and odd functions, Fourier expansion of square wave, Rectangular wave; Saw-toothed wave; Half & full rectified wave functions, Harmonic analysis.

UNIT II

Fourier integrals and Transforms: Fourier integral theorem, Fourier sine integral, Fourier cosine integral, Fourier sine Transform, Fourier cosine transform, Fourier transform and its properties, Finite Fourier sine transform, Finite Fourier cosine transform, Fourier transforms of derivatives.

UNIT III

Special Functions: Beta and Gamma functions, Bessel's functions, recurrence relations of Bessel's function, Orthogonality of Bessel function, Ber- Bei functions.

UNIT IV

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

TEXT BOOKS:

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication.

REFERENCES BOOKS:

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

ETCE 211A	STRUCTURAL ANALYSIS-I	C
		4

Overview:

Structural Analysis-I will provide an understanding about the determinate and indeterminate structures, stress and strains acting on beams, torsional forces on shafts. Students will investigate the behavior of reinforcement in various types of beams design exercises, case studies, and load testing of beams. Students will study the theory of columns and their design and will gain an appreciation of the importance of structural design today, with an emphasis on environmental impact of large-scale construction.

Objectives:

To strengthen the students' knowledge about fundamental structural forces in slabs and beams and the methods of analysis and calculations. To introduce to the forces acting on beams and to calculate their shear forces and bending moments.

Introduction to structural analysis: Definition of determinate and indeterminate structure, degree of freedom, concept of stress and strains, Mohr' circle of stress and strain, principle stress and strain examples. Stress- strain relationship hook's law, examples, composite sections

Bending Stress and Strains: Concept of bending stresses, flexural formula, stress- strain diagram for beam, shear stress in beam, shear stresses in beam with different cross-section. Concept of torsion, torsion in circular shaft, torsion equation, shear stress in shaft due to torsion examples.

Columns: Theory of column, slenderness ratio, end connections, short column, Euler's critical buckling load, eccentric loaded short column, cylinder column subjected to eccentric loading, examples.

Bending Moment and Shear force Diagram: Introduction to bending moment and shear force diagram in beam, introduction to slope and deflection in beam by differential equation,

moment- area method and conjugate beam method, principle of virtual work, Maxwell law of reciprocal deflection, Willot-Mohr diagram.

Expected Outcomes:

The course curriculum will make students load carrying capacity of beams used in the construction practices. The outcome of the course will make students capable enough to design beams, columns and shafts for construction purposes.

ETCE 211A	STRUCTURAL ANALYSIS – I	L	T	P	C
		3	1	-	4

Course Objective: Structural Analysis, being the critical part in designing building and other structures, is important. Elastic theorems fixed and continuous beams, circular beams over simple support and theory of columns are covered in this course.

UNIT I

Introduction to structural analysis: Definition of determinate and indeterminate structure, degree of freedom, concept of stress and strains, Mohr' circle of stress and strain, principle stress and strain examples. Stress- strain relationship hook's law, examples, composite sections.

UNIT II

Bending Stress and Strains: Concept of bending stresses, flexural formula, stress-strain diagram for beam, shear stress in beam, shear stresses in beam with different cross-section. Concept of torsion, torsion in circular shaft, torsion equation, shear stress in shaft due to torsion examples.

UNIT III

Columns: Theory of column, slenderness ratio, end connections, short column,Euler's critical buckling load, eccentric loaded short column, cylinder column subjected to eccentric loading,

examples.

UNIT IV

Bending Moment and Shear force Diagram: Introduction to bending moment and shear force diagram in beam, introduction to slope and deflection in beam by differential equation, moment- area method and conjugate beam method, principle of virtual work, Maxwell law of reciprocal deflection, Willot-Mohr diagram.

REFERENCES BOOKS:

1. Strength of Materials Part-I, S. Timoshenko,Affiliated East-West Press,N.Delhi
2. Mechanics of Materials, Popov Nagarjan& Lu, Prentice Hall of India,N.Delhi
3. Mechanics of Solids, Prasad, V.S. Gakgotia Pub., N.Delhi.
4. Elementary Structural Analysis, Jain, A.K., Nem Chand & Bros, Roorkee.
5. Elementary Structural Analysis, Wibur & Nooris, McGraw Hill Book Co., Newyork.
6. Structural Analysis, Bhavikatti,S.S.,Vikas Pub. House, N.Delhi.

ETCE 213A	SURVEYING-I	C
		4

Overview:

Surveying is the most important discipline which lays down the foundation for all the structures. Surveying will enable the students to know, the location and topography of ground which is important for any project. This subject deals with fundamentals of Surveying, Map System, Scale, Linear and Angular measurement, Measurement of area and volume in the field, Traversing contouring. Students will learn about the instrument used in field and their applications.

Expected Outcomes:

The course curriculum will make students understand the fundamentals of surveying & Levelling. Students will be able to handle the instruments learn their application. It will enable the students to understand detailing of the maps and use of instruments on field.

Applications:

- Surveying is important for preparing and understanding of map, planning a project etc.
- It is useful for gathering data required for planning phases of construction activities.
- To set out a work and transfer details from map to ground knowledge of surveying is used.
- To understand Topographical maps showing hills, rivers, towns, villages, forests etc.
- For planning and estimating new engineering projects like water supply and irrigation schemes, mines, railroads, bridges, transmission lines, buildings etc. surveying is required.
- Engineering map showing the position of engineering works like roads, railways, buildings, dams, canals etc. are prepared through surveying.

ETCE	SURVEYIN	L	T	P	C
		3	1	-	4

213A	**G-I**				

Course Objective: Surveying is the basic element of mapping areas for civil engineering construction. Methods of surveying including leveling, and leveling methods, contours, estimation of volumes etc. are covered.

UNIT I

Fundamental Principles of Surveying: Definition, objects, classification, fundamental principles, methods of fixing stations.

Measurement of distances: Direct measurement, instruments for measuring distance, instruments for making stations, chaining of line, errors in chaining, tape corrections examples.

UNIT II

Compass and Chain Traversing: Methods of traversing, instruments for measurement of angles-prismatic and surveyor`s compass, bearing of lines, local attraction, examples.

Levelling: Definition of terms used in levelling, types of levels and staff, temporary adjustment of levels, principles of levelling, reduction of levels, booking of staff readings, examples, contouring, characteristics of contours lines, locating contours, interpolation of contours, Calculations of volume of earth works by means of contour lines.

UNIT III

Theodolite and Theodolite Traversing: Theodolites, temporary adjustment of theodolite, measurement of angles, repetition and reiteration method, traverse surveying with theodolite, checks in traversing, adjustment of closed traverse, examples, Electronic theodolite.

Plane Table Surveying: Plane table, methods of plane table surveying, radiation, intersection, traversing and resection, two point and three-point problems.

UNIT IV

Tacheometry: Uses of tacheometry, principle of tacheometric surveying, instruments used in tacheometry, systems of tacheometric surveying-stadia system fixed hair method, determination of tacheometric constants, tangential systems, examples.

Curves: Classification of curves, elements of simple circular curve, location of tangent points-chain and tape methods, instrumental methods, examples of simple curves. Transition Curves-Length and types of transition curves, length of combined curve, examples:

Vertical Curves: Necessity and types of vertical curves.

REFERENCE BOOKS:

1. Surveying Vol.I by B.C.Punmia
2. Surveying Vol.I by T.P.Kanitkar
3. S.K Duggal, Surveying Vol 1 and II, 2nd ed., Tata - McGraw Hill, New Delhi.
4. Arora K.R., Surveying Vol I &II, Standard Book House, New Delhi.

ETCE 207A	BUILDING MATERIALS AND TECHNOLOGY	C
		4

Overview:

Fundamentals of building construction methods and materials of construction. The approach is to study the stability of buildings and materials under fire conditions. The emphasis is upon safety under fire conditions and the technology of limiting fire spread in new and existing buildings.

Objectives:

The course covers building materials and their testing, cement and its applications foundation and structural members of building. Different areas and utilities of building like floors, doors etc.

Masonry Construction: Introduction, various terms used, stone masonry – Dressing of stones, Classifications of stone masonry, safe permissible loads, introduction to green building concept and methods, Brick masonry – bonds in brick work, laying brick work, structural brick work-cavity and hollow walls, reinforced brick, Defects in brick masonry, composite stone and brick masonry, glass block masonry.

Cavity and Partition Walls: Advantages, position of cavity, types of non-bearing partitions, constructional details and precautions, construction of masonry cavity wall.

Foundation: Functions, types of shallow foundations, sub-surface investigations, geophysical methods, general feature of shallow foundation, foundations in water logged areas, design of masonry wall foundation, introduction to deep foundations i.e. pile and pier foundations.

Roofs and Floors: Types of roofs, various terms used, roof trusses -king post truss, queen post truss etc. Floor structures, ground, basement and upper floors, various types of floorings.

Doors and Windows: Locations, sizes, types of doors and windows, fixtures and fasteners for doors and windows.

Damp-Proofing and Water-Proofing: Defects and causes of dampness, prevention of dampness, materials used, damp-proofing treatment in buildings, water- proofing treatment of roofs including pitched roofs.

Acoustics, Sound Insulations and Fire Protection: Classification, measurement and transmission of sound, sound absorber, classification of absorbers, sound insulation of buildings, wall construction and acoustical design of auditorium, fire-resisting properties of materials, fire resistant construction and fire protection requirements for buildings.

Material for green building, Stones: Classification, requirements of good structural stone, quarrying, blasting and sorting out of stones, dressing, sawing and polishing, prevention and seasoning of stone.

Brick and Tiles: Classification of bricks, constituents of good brick earth, harmful ingredients,
Manufacturing of bricks, testing of bricks, Bricks prepared from fly ashtray -cotta, manufacturing of tiles and terra-cotta, types of terra-cotta, uses of Terra-cotta.

Limes, cement and mortars: Classification of lime, manufacturing, artificial hydraulic lime, pozzolana, testing of lime, storage of lime, cements composition, types of cement, manufacturing of ordinary Portland cement, testing of cement, special types of cement, storage of cement.

Mortars: Definition, proportions of lime and cement mortars, mortars for masonry and plastering.

Timber: Classification of timber, structure of timber, seasoning of timber, defects in timber, fire proofing of timber, plywood, fiber boards, Masonite and its manufacturing, important Indian timbers.

Paints and Varnishes: Basic constituents of paints, types of paints, painting of wood, constituents of varnishes, characteristics and types of varnishes.

Expected Outcomes:

The course curriculum Demonstrate an understanding of building construction as it relates to firefighter safety, building codes, fire prevention, code inspection, and firefighting strategy. Classify major types of building construction. Analyze the hazards and tactical considerations associated with the various types of building construction

ETCE 207A	BUILDING MATERIALS & TECHNOLOGY	L	T	P	C
		3	1	-	4

Course Objective: The course covers building materials and their testing, cement and its applications foundation and structural members of building. Different areas and utilities of building like floors, doors etc.

UNIT I

Masonry Construction: Introduction, various terms used, stone masonry – Dressing of stones, Classifications of stone masonry, safe permissible loads, introduction to green building concept and methods, Brick masonry – bonds in brick work, laying brick work, structural brick work-cavity and hollow walls, reinforced brick, Defects in brick masonry, composite stone and brick masonry, glass block masonry.

Cavity and Partition Walls: Advantages, position of cavity, types of non-bearing partitions, constructional details and precautions, construction of masonry cavity wall.

Foundation: Functions, types of shallow foundations, sub-surface investigations, geophysical methods, general feature of shallow foundation, foundations in water logged areas, design of masonry wall foundation, introduction to deep foundations i.e. pile and pier foundations.

UNIT II

Roofs and Floors: Types of roofs, various terms used, roof trusses -king post truss, queen post truss etc. Floor structures, ground, basement and upper floors, various types of floorings.

Doors and Windows: Locations, sizes, types of doors and windows, fixtures and fasteners for doors and windows.

UNIT III

Damp-Proofing and Water-Proofing: Defects and causes of dampness, prevention of dampness, materials used, damp-proofing treatment in buildings, water- proofing treatment of roofs including pitched roofs.

Acoustics, Sound Insulations and Fire Protection: Classification, measurement and transmission of sound, sound absorber, classification of absorbers, sound insulation of buildings, wall construction and acoustical design of auditorium, fire-resisting properties of materials, fire resistant construction and fire protection requirements for buildings.

UNIT IV

Material for green building, Stones: Classification, requirements of good structural stone, quarrying, blasting and sorting out of stones, dressing, sawing and polishing, prevention and seasoning of stone.

Brick and Tiles: Classification of bricks, constituents of good brick earth, harmful ingredients,
Manufacturing of bricks, testing of bricks, Bricks prepared from fly ash. Terra -cotta, manufacturing of tiles and terra-cotta, types of terra-cotta, uses of
Terra-cotta.

Limes, cement and mortars: Classification of lime, manufacturing, artificial hydraulic lime, pozzolona, testing of lime, storage of lime, cements composition, types of cement, manufacturing of ordinary portland cement, testing of cement, special types of cement, storage of cement.

Mortars: Definition, proportions of lime and cement mortars, mortars for masonry and plastering.

Timber: Classification of timber, structure of timber, seasoning of timber, defects in timber, fire proofing of timber, plywood, fiber boards, masonite and its manufacturing, important Indian timbers.

Paints and Varnishes: Basic constituents of paints, types of paints, painting of wood, constituents of varnishes, characteristics and types of varnishes.

REFERENCE BOOKS:

1 Building Construction, Sushil Kumar, Standard Pub., N. Delhi
2 Building Material, Rangawala
3 Construction Engineering, Y.S. Sane
4 Building Construction, Gurcharan Singh, Standard Pub., N. Delhi.

ETCE 217A	FLUID MECHANICS	C
		4

Course Objective:

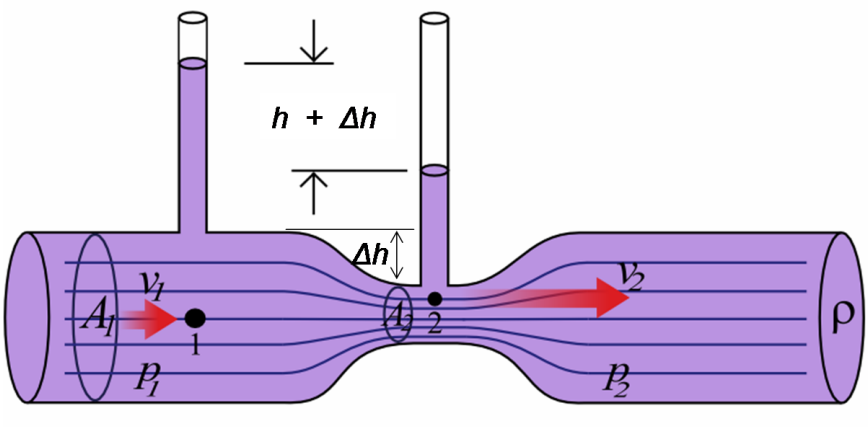
The objective of Fluid Mechanics subject is that students should understand the, properties of fluids, pressure measurement devices, hydraulic forces on surfaces, bouncy and flotation in fluids, kinematics and static behavior of fluids, dimension and model analysis, laminar and turbulent flow, flow through pipes and orifices, boundary layer theory.

Course Outcome:

Students will able to understand the basic concept of physical and mathematical methods used in analyzing engineering applications involving fluids. Understanding of basic physics of fluids. Gaining knowledge to calculate and design engineering applications involving fluid. Understanding of analyzing flow systems in terms of mass, momentum, and energy balance. Having knowledge about current research topics about fluid mechanics.

Application:

In Geophysical phenomenon, Navel architecture, Hydrology, Aerospace, Aerodynamics, Micro fluidics, Quantum mechanics, Magneto-hydrodynamic, Cardiovascular study, Biophysics, Pipe network, Turbo-machinery.



ETCE 217A	FLUID MECHANICS	L	T	P	C
		3	1	-	4

Course Objective: This course will provide an insight into fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.

UNIT I

Fluid Properties: Concept of fluid and flow, ideal and real fluids, continuum concept, and properties of fluids, surface tension, capillarity, Newtonian and non-Newtonian fluids.

Fluid Statics: Pressure-density-height relationship, gauge and absolute pressure, simple differential and sensitive manometers, two liquid manometers, pressure on plane and curved surfaces, centre of pressure, Buoyancy, stability of immersed and floating bodies, determination of metacentric height, fluid masses subjected to uniform acceleration.

UNIT II

Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net, Problems.

Fluid Dynamics: Concept of system and control volume, Euler's equation, Bernoulli's equation, venturimeter, orifices, orificemeter, mouthpieces, kinetic and momentum correction factors, Impulse momentum relationship and its applications, Problems.

UNIT III

Flow Through Pipes: Major and minor losses in pipes, Hagen-Poiseuilli law, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes, Problems.

UNIT IV

Boundary Layer Flow: Boundary layer concept, displacement, momentum and energythickness, von-karman momentum integral equation, laminar and turbulent boundary

layer flows, drag on a flat plate, boundary layer separation and control. Streamlined and bluff bodies lift and drag on a cylinder and an airfoil, Problems.

Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, Buckingham theorem, important dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, physical modeling, similar and distorted models.

TEXT BOOKS

Fluid Mechanics and Hydraulic Machines – Dr. R.K.Bansal – Laxmi Publishers.

REFERENCES BOOKS:

1. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
3. Fluid Mechanics and Machinery – S.K. Agarwal, TMH, New Delhi.
4. Fluid Mechanics – Dr. R.K. Rajput – Khanna Publications.

ETCE264A	DISASTER PREPAREDNESS AND PLANNING	C
		3

Course Objective:

The overall aim of this course is to provide broad understanding about the basic concepts of Disaster Management with preparedness as a Civil Engineer. Further, the course introduces the various natural hazards that can pose risk to property, lives, and livestock, etc. and understanding of the social responsibility as an engineer towards preparedness as well as mitigating the damages.

The objectives of the course are:

i) To understand basic concepts in Disaster Management.

ii) To understand Definitions and Terminologies used in Disaster Management.

iii) To understand Types and Categories of Disasters.

iv) To understand the Challenges posed by Disasters.

vi) To understand Impacts of Disasters Key Skills.

Course Outcomes:

The student will develop competencies in:

- The application of Disaster Concepts to Management.
- Analyzing Relationship between Development and Disasters.
- Ability to understand Categories of Disasters.
- Realization of the responsibilities to society.

ETCE 264A	DISASTER PREPAREDNESS	L	T	P	C
		3	-	-	3

	& PLANNING				

Course Objective:

The objectives of the course are i) To Understand basic concepts in Disaster Management ii) To Understand Definitions and Terminologies used in Disaster Management iii) To Understand Types and Categories of Disasters iv). To Understand the Challenges posed by Disasters vi) To understand Impacts of Disasters Key Skills

Unit 1: Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation).

Unit 2: Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit 3: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Unit 4: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Postdisaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmers in India and the activities of National Disaster Management Authority.

Unit 5: Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land usechanges, urbanization etc.), sustainable and environmentally friendly recovery; reconstruction and development methods.

TEXT BOOKS:

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

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

3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.

REFERENCE BOOKS:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)

2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

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

Objective:

Surveying & Levelling is the most important discipline which lays down the foundation for all the structures. Surveying & Levelling will enable the students to know, the location and topography of ground which is important for any project. This subject deals with fundamentals of Surveying, Map System, Scale, Linear and Angular measurement,

Measurement of area and volume in the field, Chaining, Traversing and contouring. Students will learn about the instrument used in field and their applications.

Outcomes:

After completing the course, the students will be able to:

- Select station, can take taking offsets, booking the field notes
- To carry out Compass Surveying.
- Traversing using prismatic and surveyor compass
- Leveling: Book of the readings and reduction of levels.
- Plane Tabling: Equipment and methods used in plane table surveying.
- Contouring: Interpretation and preparation of contour maps, Site modeling with total station, Exercises in setting out of building works.
- Theodolite Surveying: Theodolite, its temporary and permanent adjustment, measuring of magnetic bearings, horizontal & vertical angles, Theodolite traverse and balancing the closing error.

Applications:

Through this course students will acquire practical knowledge on handling basic survey instruments including Chaining, Compass, Theodolite, Tachometry, Auto Level, Total Station and will have adequate knowledge to carryout Triangulation, Traversing and general field marking for various architectural projects and Location of site.

ETCE 261A	SURVEYING-I LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

- Chain survey - Traversing and plotting of details.
- Compass survey - Traversing with compass and plotting.
- Plane table survey – Method of Radiation and Intersection.
- Plane table survey - Solving three-point problem.
- Plane table survey – Solving two-point problem.
- Plane table survey - Traverse.
- Levelling Fly leveling – Plane of collimation method.
- Levelling Fly leveling – Rise and Fall method.
- Levelling Longitudinal and cross sectioning.
- Levelling Contour surveying.
- Theodolite surveying – Measurement of horizontal angle by method of repetition and reiteration.

ETME 255A	FLUID MECHANICS LAB	C
		1

Course Objectives:

1) To compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows.
2) To discuss and practice standard measurement techniques of fluid mechanics and their applications
3) To learn and practice writing technical reports.

4) To work on small design projects.

Course Outcomes:

List of Experiments Fundamentals of Fluid Mechanics and Hydraulic Machinery

1. To provide practical knowledge in verification of principles of fluid flow
2. To impart knowledge in measuring pressure, discharge and velocity of fluid flow
3. To understand Major and Minor Losses.

Applications:

To provide the students with a solid foundation in fluid flow principles.

1. Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles.
2. Given the required flow rate and pressure rise, select the proper pump to optimize the pumping efficiency.
3. To provide exposure to modern computational techniques in fluid dynamics.

ETME 255A	FLUID MECHANICS LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To determine the coefficient of impact for vanes.
2. To determine coefficient of discharge of an orifice meter.
3. To determine the coefficient of discharge of Notch (V and Rectangular types).
4. To determine the friction factor for the pipes.
5. To determine the coefficient of discharge of venturimeter.
6. To determine the coefficient of discharge, contraction & velocity of an orifice.
7. To verify the Bernoullis Theorem.
8. To find critical Reynolds number for a pipe flow.
9. To determine the meta-centric height of a floating body.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
11. To show the velocity and pressure variation with radius in a forced vertex flow.
12. To verify the momentum equation.

ETCE 257A	STRUCTURE ANALYSIS-I LAB	C
		1

Overview:

Structural Analysis-I will provide an understanding about the determinate and indeterminate structures, arches, cable and suspension bridges, analysis of trusses. Students will investigate deflection in various types of beams, curved members and do load testing of structures. Students will study the behavior of struts and will gain an appreciation of the importance of structural design today, with an emphasis on environmental impact of large-scale construction.

Objectives:

To introduce the students to concept of global structural stability, theory of structural analysis, and methods in structural analysis. Following are the experiments students will perform in this lab.
Verification of reciprocal theorem of deflection using a simply supported beam.
Verification of moment area theorem for slopes and deflections of the beam.

Deflections of a truss- horizontal deflections & vertical deflections of various joints of a pin-jointed truss.
Elastic displacements (vertical & horizontal) of curved members.

Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
Experimental and analytical study of behavior of struts with various end conditions.
To determine elastic properties of a beam.

Uniaxial tension test for steel (plain & deformed bars)
Uniaxial compression test on concrete & bricks specimens.

Expected Outcomes:

On completing this course, the student shall be able to:

i. Verification of reciprocal theorem

ii. Conduct approximate analysis of structures like curved members.

iii. Conduct systematic analysis of three hinged arches.

iv. Calculate the characteristic compressive strength of concrete.

ETCE 257A	STRUCTURAL ANALYSIS - I LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Verification of reciprocal theorem of deflection using a simply supported beam.
2. Verification of moment area theorem for slopes and deflections of the beam.
3. Deflections of a truss- horizontal deflections & vertical deflections of various joints of a pin- jointed truss.
4. Elastic displacements (vertical & horizontal) of curved members.
5. Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
6. Experimental and analytical study of behavior of struts with various end conditions.
7. To determine elastic properties of a beam.
8. Uniaxial tension test for steel (plain & deformed bars)
9. Uniaxial compression test on concrete & bricks specimens.

ETCE 260A	BUILDING DRAWING LAB	C
		1

Course Objectives:

This subject is to understand the different views of the components of the building structures and capable of viewing and drawing the plan, elevation and section of the different types of the building.

Course Outcome:

1. Understanding the basic commands, principles and features behind AutoCAD.

2. Utilize CAD software for scaled drawing.

3. Students will acquire sufficient knowledge of AutoCAD to allow them to prepare drawing skills with the aid of the computer.

Application:

On completion of this module, the student must be able to draw different type of drawings required for construction of buildings. As well as Understand the basic steps of building construction and their components.

ETCE260A	BUILDING DRAWING LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

Drafting of following Using Any CAD software

1. Symbols used in Civil Engineering drawing, Masonry Bonds
2. Doors, Windows and staircases.
3. Plumbing & Electrical fitting drawing.
4. Comprehensive Drawing of Residential building (Layout, plan, elevation & sectional elevation, plumbing & electrical fillings in out)
5. Preparation of Layout planning of different civil engg. Projects.
6. Preparation of lay out plan/Maps and building drawing using computer.

SEMESTER IV

ETCE 214A	SURVEYING AND GEOMATICS	C
		4

Overview:

Surveying is the most important discipline which lays down the foundation for all the structures. Surveying will enable the students to know, the location and topography of ground which is important for any project. This subject deals with fundamentals of Surveying, Map System, Scale, Linear and Angular measurement, Measurement of area and volume in the field, curves, Triangulations, astronomical and aerial survey. Students will learn about the instrument used in field and their applications.

Expected Outcomes:

The course curriculum will make students understand the fundamentals of surveying & Levelling. Students will be able to handle the instruments learn their application. It will enable the students to understand detailing of the maps which is the basic requirement for carrying out any construction activity.

Applications-

- Surveying is important for preparing and understanding of map, planning a project etc.
- It is useful for gathering data required for planning phases of construction activities.
- To set out a work and transfer details from map to ground knowledge of surveying is used.
- To understand Topographical maps showing hills, rivers, towns, villages, forests etc.
- For planning and estimating new engineering projects like water supply and irrigation schemes, mines, railroads, bridges, transmission lines, buildings etc. surveying is required.
- Engineering map showing the position of engineering works like roads, railways, buildings, dams, canals etc. are prepared through surveying.

ETCE 214A	SURVEYING AND GEOMATICS	L	T	P	C
		3	1	-	4

Course Objective: Surveying is the basic element of mapping areas for civil engineering construction. Methods of surveying including leveling, and leveling methods, contours, estimation of volumes etc. are covered.

UNIT I

Tacheometry: Uses of tacheometry, principle of tacheometric surveying, instruments used in tacheometry, systems of tacheometric surveying-stadia system fixed hair method, determination of tacheometric constants, tangential systems, examples.

Measurement of distances: Curves: Classification of curves, elements of simple circular curve,
location of tangent points-chain and tape methods, instrumental methods, examples of simple curves. Transition Curves-Length and types of transition curves, length of combined curve, examples:

Vertical Curves: Necessity and types of vertical curves.

UNIT II

Survey Adjustment and Treatment of Observations: Definite weight of an observation, most probable values, type of error, principle of least squares, and adjustment of triangulation figures by method of least squares.

Astronomy: Definitions of astronomical terms, star at elongation, star at prime vertical star at horizon, star at culmination, celestial coordinate systems, Napier`s rule of circular parts, various time systems: sidereal, apparent, solar and mean solar time, equation of time-its cause, effect, determination of longitude, inter-conversion of time, determination of time, azimuth and latitude by astronomical observations.

UNIT III

Elements of Photogrammetry: Introduction: types of photographs, Terrestrial and aerial photographs aerial camera and height displacements in vertical photographs, stereoscopic vision and stereoscopies, height determination from parallax measurement, flight planning, plotting by radiline method, principle of photo interpretation and photogram metric monitoring in Civil Engineering.

UNIT IV

Introduction of remote sensing and its systems- Analysis /measurements on remote sensing analysis.and interpretation of data
Concept of G.I.S and G.P.S-Basic Components, data input, storage & output.

TEXT BOOKS:

1. Surveying Vol.II by B.C.Punmia.

REFERENCE BOOKS:

1. Surveying Vol.II by T.P.Kanitkar
2. S.K Duggal, Surveying Vol 1 and II, 2nd ed., Tata - McGraw Hill, New Delhi.
3. Arora K.R., Surveying Vol I &II, Standard Book House, New Delhi.

ETCE 206A	CONSTRUCTION & CONCRETE TECHNOLOGY	C
		4

Course Objective:

This course requires the student to know about the basic of civil engineering, fundamentals of chemistry, building materials, statics etc.

Course Outcomes:

Concrete types and practical application. Selection of concrete mix proportions (mix design), fresh concrete properties. Cement types and their properties, pozzolanic additives, properties of the binder phase. Properties of aggregates and their influence, types and use of admixtures. Curing technology and shrinkage/crack sensitivity. Mechanical properties. Permeability and durability with regard to physical and chemical deterioration, including reinforcement corrosion.

Course Applications:

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

A. Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy acquire and apply fundamental knowledge in the fresh and hardened properties of concrete.

B. Evaluate the effect of the environment on service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non-Destructive Testing of concrete structure.

C. Develop an awareness of the utilization of waste materials as novel innovative materials for use in concrete.

D. Design a concrete mix which fulfills the required properties for fresh and hardened concrete.

ETCE206A	CONSTRUCTION &CONCRETE TECHNOLOGY	L	T	P	C
		3	1	-	4

Course Objective: The course covers concrete making materials and their testing, heavy constructions and equipment etc.

UNITI

CONCRETE TECHNOLOGY - Concrete making materials: cements, aggregates, water, admixtures, properties of fresh and hardened concrete, variability of concrete strength, extreme weather concreting, testing of concrete mixes, pre-stressed concrete.

UNIT II

SPECIAL CONCRETES- Concretes, Behaviour of concretes – Properties and Advantages of High Strength and High-Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self-compacting concrete, Alternate Materials to concrete on high performance & high Strength concrete.

COMPOSITES-Types of Plastics, Properties & Manufacturing process, Advantages of Reinforced polymers, Types of FRP, FRP on different structural elements, Applications of FRP.

UNIT III

MIX DESIGN- Principles of concrete mix design, basic considerations, Factors in the choice of mix design, outline of mix design procedure, ACI mix design practice, USBR method, British mix design method IS guidelines.

CHEMICAL ADMIXTURES: Water reducers, superplasticizers, accelerators, retarders, air entraining admixtures

MINERAL ADDITIVES: Slags, fly ashes, rice husk ash, metakaolin, calcined clays, silica fume, and limestone powder.

UNIT IV

HEAVY CONSTRUCTION- Construction of large structures, dams, bridges, multi-storeyed buildings etc.

CONSTRUCTION EQUIPMENTS- Introduction to heavy construction equipment, crushers, hot mix, plants, dozers etc.

REFERENCE BOOKS:

1. Handbook of mix design - BIS
2. PERT & CPM by B.C. Punmia
3. Concrete Technology by M.S. Shetty.
4. P.K. Mehta and P.J.M. Monteiro, "Concrete Microstructure, Properties and Materials", Third Edition, Tata McGraw Hill 2006.

ETCE 204A	SOIL MECHANICS	C 4

Course Objective:

The course covers soil formation, composition, classification, properties of soil their testing and its applications. The students will understand the basic concept of physical properties of soil, together with knowledge of basic engineering procedures to identify factors controlling soil behavior and methods to determine soil properties.

Course outcome:

Students will be able to understand the origin of the soil and geological cycle. Apply principles of phase diagram for soil properties and perform basic weight-volume calculations. Able to understand consistency of soil by Atterberg limits. Use AASHTO method as well as Unified Soil Classification System for soil classification. Will be able to get the basic science of soil compaction. Understand basics principles of flow and soil permeability through porous media including Bernoulli's equation, Darcy's Law, and Hydraulic conductivity. Understand seepage in soil include Laplace equation of continuity. Construct flow nets for

water flow calculations. Calculate in situ stress in saturated soil with and without seepage, seepage force, and implement measures to control heave in soil. Understand how stresses are transferred through soils and be able to compute both geostatic and induced stresses due to point, line, and area loads. Estimate the amount of consolidation and settlement and time required for settlement under a given load. Basic knowledge of shear strength principles including the Mohr-Coulomb failure criterion.

Applications:

Soil mechanics is used to analyze the deformations and flow of fluids within natural and man-made structures that are supported on or made of soil, or structures that are buried in soils. Example applications are building and bridge foundations, retaining walls, dams, and buried pipeline systems. Best example is leaning tower of Pisa & Palm Island in Dubai.

ETCE204A	SOIL MECHANICS	L	T	P	C
		3	1	-	4

Course Objective: The course covers soil formation, composition, classification, properties of building materials and their testing, cement and its applications foundation and structural members of building. Different areas and utilities of building like floors, doors etc.

UNIT I

Soil Formation and Composition: Introduction, soil and rock, Soil Mechanics and Foundation Engineering, origin of soils, weathering, soilformation, major soil deposits of India, particle size, particle shape, inter-particle forces, soil structure,principal clay minerals.
Basic Soil Properties: Introduction, three phase system, weight-volume relationships, soil grain properties, soil aggregate properties, grain size analysis, sieve analysis, sedimentation analysis, grain size distribution curves,consistency of soils, consistency limits and their determination, activity of clays, relative density of sands.

UNIT II

Classification of soils: Purpose of classification, classification on the basis of grain size, classification on the basis of plasticity,plasticity chart, Indian Standard Classification System.Permeability of Soils. Introduction, Darcy`s law and its validity, discharge velocity and seepage velocity, factors affectingpermeability, laboratory determination of coefficient of permeability, determination of field permeability,permeability of stratified deposits.

Effective Stress ConceptPrinciple of effective stress: effective stress under hydrostatic conditions, capillary rise in soils, effectivestress in the zone of capillary rise, effective stress under steady state hydro-dynamic conditions, seepageforce, quick condition, critical hydraulic gradient, two-dimensional flow, Laplace`s equation, propertiesand utilities of flow net, graphical method of construction of flow nets, piping, protective filter.

UNIT III

Compaction: Introduction, role of moisture and compactive effect in compaction, laboratory determination of optimummoisture content, moisture density relationship, compaction in field, compaction of cohesionless soils,moderately cohesive soils and clays, field control of compaction.

Vertical Stress below Applied Loads:

Introduction, Boussinesq`s equation, vertical stress distribution diagrams, vertical stress beneath loadedareas, Newmark`s influence chart, approximate stress distribution methods for loaded areas, Westergaard`sanalysis, contact pressure.

UNIT IV

Compressibility and Consolidation:

Introduction, components of total settlement, consolidation process, one-dimensional consolidation test, typical void ratio-pressure relationships for sands and clays, normally consolidated and over consolidated clays, Casagrande`s graphical method of estimating pre-consolidation pressure, Terzaghi`s theory of one-dimensional primary consolidation, determination of coefficients of consolidation, consolidation settlement, Construction period settlement, secondary consolidation.

REFERENCE BOOKS:

1. Basic and Applied Soil Mechanics by Gopal Ranjan, ASR Rao, New AgeInternational(P)Ltd.Pub.N.Delhi.
2. Soil Engg. in Theory and Practice, Vol. I, Fundamentals and General Principles by Alam Singh, CBSPub.,N.Delhi.
3. Engg.Properties of Soils by S.K.Gulati, Tata-McGrawHill,N.Delhi.
4. Geotechnical Engg. ByP.PurshotamRaj,TataMcGraw Hill.
5. Principles of Geotechnical Engineering by B.M.Das,PWS KENT, Boston.

ETCE 321A	PROJECT PLANNING AND MANAGEMENT	C
		3

Course Objective:

By understanding the fundamentals of project management, student will be better prepared to initiate a project in an organization and position it for success. In this course, student will identify effective project management practices and their related processes

Course Outcome:

- Identify the key processes and requirements of project management.
- Initiate a project.
- Plan for time and cost.
- Plan for project risks, communication, and change control.
- Execute, manage, and control a project.

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Course Application:

- Apply project characteristics to his/her own project.
- Identify skills necessary to manage a project.
- Initiate the process of managing a project.
- Define the requirements for scoping, scheduling and costing a project.
- Develop an effective project team

ETCE 321A	PROJECT PLANNING AND MANAGEMENT	L	T	P	C
		3	1	-	4

Course Objective: To train the students with the latest and the best in the rapidly changing fields of Construction Engineering, Technology and Management and to prepare the students to be industry leaders who implement the best engineering and management practices and technologies in the construction industry.

Unit I

Introduction: Indian construction Industry, Construction project management and its relevance. Stakeholders of a construction project. Project organization.

Construction Economics: Introduction. Economic decision making. Cash-flow diagrams. Present worth comparison, Future worth comparison, Annual cost and worth comparison, Rate of return method. Project cost estimation- preliminary and revised estimates.

Unit II

Construction Equipments: Brief study of equipments required for earth work, dredging, conveyance, concreting, hoisting, pile driving, compaction and grouting. Investment and operating costs, output of various equipments.

Networks: Elements of Networks and their definitions, events and Activities Rules of Network, partial situation and Fulkerson's rule. Development of Network. Forward planning, Backward planning event oriented, Activity oriented networks; Plan Breakdown; Sequencing example: House construction

Unit III

Management techniques: CTPM, PERT and BAR CHARTING with particular reference to Building Construction PERT - Time computations, Earliest expected time and its formulations, Latest allowable time and its computation; CPM - Network Analysis, Planning, scheduling and control; Start and finish times of activity EST, EFT, LST and LFT; Float and Total Floats, Free floats, Independent floats, Interfering floats; Per-critical, Sub-critical, Critical Activities, PERT network Analysis, Slack positive, Negative, Zero slacks and Critical Paths in Network.

Unit IV

Management techniques (contd.): CPM Cost Model, Resource allocation and Histograms; Project Management Software.

Public Works Accounts: Various forms used in construction works, Measurement book, Cash book, Material at site account, Imprest account, Stock tools and plants, Various types of running bills, Secured advance, Final bills. Construction quality management.

Reference Books:

1. SHARMA S. C.: Construction Equipment and Management

2. PEURIFOY R. L.: Construction Planning, Equipments and Materials

3. PUNMIA B. C.: CPM and PERT Analysis.

ETCE 317A	STRUCTURAL ANALYSIS-II	C
		4

Overview:

Structural Analysis-II will provide an understanding about the determinate and indeterminate structures, arches, cable and suspension bridges, analysis of trusses. Students will investigate the behavior of reinforcement in various types of arches design exercises, case studies, and load testing of structures. Students will study the trusses and their design and will gain an appreciation of the importance of structural design today, with an emphasis on environmental impact of large-scale construction.

Objectives:

To strengthen the students' knowledge about fundamental structural forces in arches and cable and suspension bridges and the methods of analysis and calculations. To introduce to the forces acting on arches and to calculate their shear forces and bending moments.

Statically Indeterminate Structures-Concept of rolling load, design of maximum bending moment, shear force due to rolling load, concept of influence lines in beams.

Slope deflection and moment Distribution Methods- Analysis of continuous beams & portal frames, Portal frames with inclined members.

Three hinged arch-horizontal thrust; shear force and bending moment diagrams. Bending moment and shear force in determinate beams and frames, definition and signs, conventions, axial force, shear force and B.M diagrams.

Cable and suspension Bridges - Introduction, uniformly loaded cables, Temperature stresses, and three hinged stiffening Girder and two hinged stiffening Girder.

Analysis of statically determinate trusses-Introduction, various types, stability, analysis of plane trusses by method of joints and method of sections, analysis of space trusses using tension coefficient method.

Expected Outcomes:

The course curriculum will make students load carrying capacity of arches and suspension bridges used in the construction practices. The outcome of the course will make students capable enough to design arches, bridges and trusses for construction purposes.

ETCE 317A	STRUCTURE ANALYSIS - II	L	T	P	C
		3	1	-	4

Course Objective: The objective of the course is to provide a brief knowledge of structure analysis to the Engineering students. The students will learn about the Castgliano's theorem, Bending moment, Deflection, Shear centre etc.

UNIT I

Statically Indeterminate Structures-Introduction, Static and Kinematic Indeterminacies, Castigliano`s theorems, Strain energy method, Analysis of frames with one or two redundant members using Castigliano`s 2nd theorem. Concept of rolling load, design of maximum bending moment, shear force due to rolling load, concept of influence lines in beams.
Slope deflection and moment Distribution Methods- Analysis of continuous beams & portal frames, Portal frames with inclined members.

UNIT II

Three hinged arch-horizontal thrust; shear force and bending moment diagrams. Bending moment and shear force in determinate beams and frames, definition and signs, conventions, axial force, shear force and B.M diagrams.

UNIT III

Cable and suspension Bridges - Introduction, uniformly loaded cables, Temperature stresses, and three hinged stiffening Girder and two hinged stiffening Girder.

UNIT IV

Analysis of statically determinate trusses-Introduction, various types, stability, analysis of plane trusses by method of joints and method of sections, analysis of space trusses using tension coefficient method.

REFERENCE BOOKS:

1. Statically Indeterminate Structures, C.K. Wang, McGraw Hill Book Co., New York.

2. Advanced Structural Analysis, A.K. Jain, Nem Chand & Bros., Roorkee.

3. Indeterminate Structures, R.L. Jindal, S. Chand & Co., New Delhi.

4. Theory of Structures, Vol. I, S.P. Gupta &G.S.Pandit, Tata McGraw Hill, New Delhi

ETCE 216A	FLUID MACHINES	C 4

Course Objective:

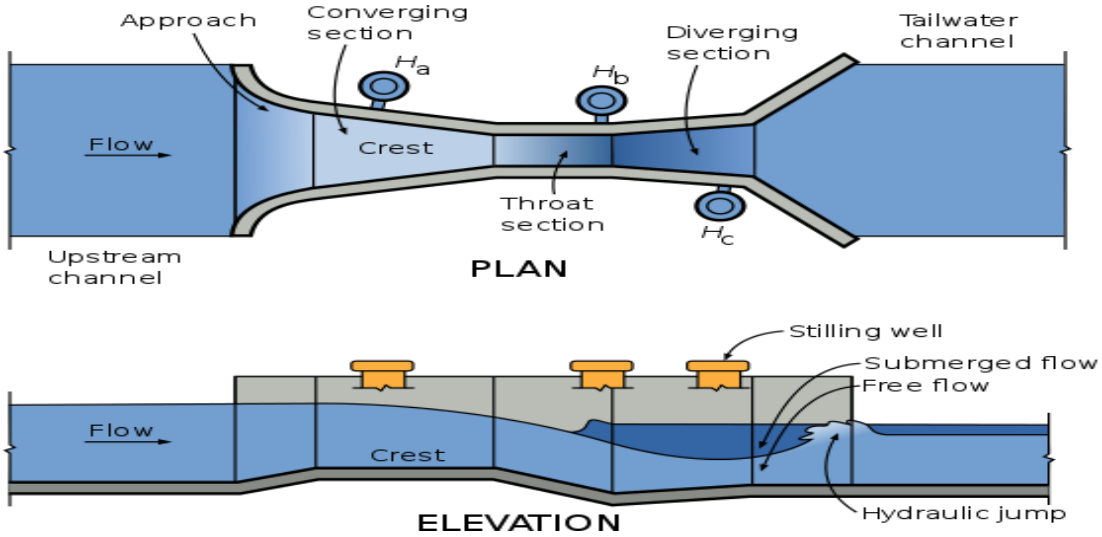
The objective of Fluid Machinery subject is that students should understand the properties of fluids, dynamic behavior of fluids, dimension and model analysis, turbulent flow, flow through open channels, different types of machines.

Course outcome:

After completing the program, the student will able to understand the concept of different types of turbines as well as Pumps. Students will able deal with importance of dimensionless numbers and its significance. Moto of this subject is to provide the information on the function of behavior of fluids & flow through open channel.

Applications:

Learned basic properties and characteristics of incompressible fluid. Understood basic fundamental theorems governing fluid flows i.e., continuity, energy and momentum.Learned the measurement of different fluid properties using various type of equipments like measurement of flow, pressure velocity and head loss. Learned the analysis of flow phenomenon through open channels



ETCE 216A	FLUID MACHINES	L	T	P	C
		3	1	-	4

Course Objective: The objective of Fluid Machinery subject is that students should understand the properties of fluids, dynamic behavior of fluids, dimension and model analysis, turbulent flow, flow through open channels, different types of machines.

UNIT I

Turbulent flow: Introduction to turbulent flow, mixing length theory, velocity distribution in turbulent flow, resistance of smooth and artificially roughened pipes, commercial pipes, aging of pipes. Losses due to sudden expansion and contraction, losses in pipe fittings and valves, concepts of equivalent length of pipe, hydraulic and energy gradient lines, pipes in series, pipes in parallel, branching of pipes, pipe network siphon, water Hammer (only quick closure case). transmission of power through pipelines.

UNIT II

Flow in open channels: Uniform flow Basic concepts, Resistance equations (Chey's and manning's formulae), Uniform flow computations, Efficient channel section, specific energy concept critical flow and its computations, channel transitions.

Flow in open channels: Non-uniform flow gradually varied flow-basic assumptions and dynamic equations of gradually flow. Types of slopes and their characteristics, analysis and computations of flow profiles, brink dept analysis, surges in open channels.

UNIT III

Turbines: Classification definitions, similarly laws, specific speed and unit quantities, Pelton turbines- their construction and settings, speed regulation dimensions of various element. Action of jet, torque, power and efficiency for ideal case, characteristic curves. Reaction turbines.

Construction & setting draft tube theory, runaway speed, working proportion of hydraulic turbines and characteristic curves, cavitation.

Forces on immersed bodies: types of drag on a sphere, a flat plate.

UNIT IV

Pumps: Centrifugal pumps: Various types and their important components, Manometric, total head, net positive suction head, specific speed, shut off head, cavitation. Principle of working and characteristic curves. Priming and maintenance. Submersible pumps.

Reciprocating pumps: principle of working, coefficient of discharge, slip, single acting and double acting pump. Manometric head, Acceleration head, Working of air vessels, simplex, duplex and three throw pumps, construction and discharge. Air lift pump.

REFERENCE BOOKS:

1. Fluid Mechanics - Streeter &Wyile.
2. Fluid Mech. & Hyd. M/cs by Modi & Seth
3. Open channel Hydraulics - V.T. Chow.
4. Hydraulic Machines - J.Lal.
5. Fluid Mechanics by A.K. Jain
6. Fluid Mechanics - Subramanyam.

ETCE 255A	FLUID MACHINES LAB	C
		1

Course Objectives:

To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

Course Outcomes:

The Practical exposure to the student enables him conduct necessary test to evaluation the performance of various flow measuring equipment and hydraulic turbines and pumps like Pelton wheel turbine, Francis Turbine, Kaplan Turbine, Reciprocating pump & Centrifugal pump.

Applications:

1.To gain knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head.

2. To provide the students knowledge in calculating performance analysis in turbines and pumps and can be used in power plants.

3. Conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.

ETCE255A	FLUID MACHINES LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
2. To draw the following performance characteristics of Pelton turbine-constant head, constant speed and constant efficiency curves.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.
6. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
8. To study the constructional details of a Reciprocating Pump and draw its characteristics curves.
9. To study the construction details of a Gear oil pump and its performance curves.
10. To study the constructional details of a Hydraulic Ram and determine its various efficiencies.
11. To study the constructional details of a Centrifugal compressor.
12. To study the model of Hydro power plant and draw its layout.

ETCE256 A	CONSTRUCTION AND CONCRETE TECHONOLOGY LAB	C 1

Course Learning Objectives:

To test the basic properties ingredients of concrete, fresh and hardened concrete properties. As well as tounderstand the procedure of designing the concrete mix of given specification of its ingredients along with appropriate water cement ratio and admixtures.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Determine the consistency and fineness of cement.
2. Determine the setting times of cement.
3. Determine the specific gravity and soundness of cement.
4. Determine the compressive strength of cement.
5. Determine the workability of cement concrete by compaction factor, slump and Vee – Bee tests
6. Determine the specific gravity of coarse aggregate and fine aggregate by Sieve analysis.
7. Determine the flakiness and elongation index of aggregates.
8. Determine the bulking of sand.
9. Understand the non-destructive testing procedures on concrete.

Applications:

1. Student will able to perform different tests conducted on cement, aggregate and concrete at site.

2. Able to understand the concept of design the concrete mix as per the site conditions and specification of materials available there.

3. As well as able to do non-destructive test on concrete.

ETCE256A	CONSTRUCTION & CONCRETE TECHNOLOGY LAB	L	T	P	C
		-	-	2	1

TESTS ON CEMENT

1. Standard consistency of cement using Vicat`s apparatus.
2. Fineness of cement by Sieve analysis and Blaine`s air permeability method.
3. Soundness of cement by Le-Chatelier`s apparatus.
4. Setting time of cement, initial and final.
5. Compressive strength of cement.
6. Measurement of specific gravity of cement.
7. Measurement of Heat of Hydration of cement.

TESTS ON AGGREGATES

1. Moisture content and bulking of fine aggregate.
2. Fineness modulus of coarse and fine aggregates.

TESTS ON CONCRETE

1. Workability of cement concrete by (a) Slump test (b) Compaction factor test(c) Flow table test
2. Compressive strength of concrete by (a) Cube test, (b) Cylinder test 3 Indirect tensile strength of concrete-split cylinder test.
3. Modules of rupture of concrete by flexure test
4. Bond strength between steel bar and concrete by pull-out test
5. Non-destructive testing of concrete.

REFERENCE BOOKS:

1. Concrete Manual-M.L. Gambhir, Dhanpat Rai & Sons, N. Delhi Concrete Technology -M.L. Gambhir, Tata McGraw Hill, N. Delhi

ETCE 258A	STRUCTURE ANALYSIS-II LAB	C
		1

Overview:

Structural Analysis-II will provide an understanding about the determinate and indeterminate structures, arches, cable and suspension bridges, analysis of trusses. Students will investigate deflection in various types of arches, portal frames and do load testing of structures. Students will study the trusses and their design and will gain an appreciation of the importance of structural design today, with an emphasis on environmental impact of large-scale construction.

Objectives:

To introduce the students to concept of global structural stability, theory of structural analysis, and methods in structural analysis. Following are the experiments students will perform in this lab.
Experiment on a two- hinged arch for horizontal thrust & influence line for Horizontal thrust
Experimental and analytical study of a 3-bar pin jointed Truss.
Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.
Begg`sdeformeter- verification of Muller Breslau principle.
Experimental and analytical study of an elastically coupled beam.
Sway in portal frames - demonstration.
To study the cable geometry and statics for different loading conditions.

To plot stress -strain curve for concrete. Use of mechanical and electrical strain and stress gauges.

Expected Outcomes:

On completing this course, the student shall be able to:

i. Apply the principle of virtual work to analyze trusses, beams & frames

ii. Conduct approximate analysis of indeterminate structures like portal frames.

iii. Conduct systematic analysis of two hinged arches.

ETCE 258A	STRUCTURE ANALYSIS-II LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS:

1. Experiment on a two- hinged arch for horizontal thrust & influence line for Horizontal thrust
2. Experimental and analytical study of a 3-bar pin jointed Truss.
3. Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.
4. Begg`sdeformeter- verification of Muller Breslau principle.
5. Experimental and analytical study of an elastically coupled beam.
6. Sway in portal frames - demonstration.
7. To study the cable geometry and statics for different loading conditions.
8. To plot stress -strain curve for concrete. Use of mechanical and electrical strain and stress gauges.

ETCE262A	SURVEYING- II LAB	C 1

Objective:

Surveying & Levelling is the most important discipline which lays down the foundation for all the structures. Surveying & Levelling will enable the students to know, the location and topography of ground which is important for any project. This subject deals with fundamentals of Surveying, Map System, Scale, Linear and Angular measurement, Measurement of area and volume in the field, Chaining, Traversing and contouring. Students will learn about the instrument used in field and their applications

Outcomes:

After completing the course, the students will be able to:

- Select station, can take taking offsets, booking the field notes
- To carry out Compass Surveying.
- Traversing using prismatic and surveyor compass
- Leveling: Book of the readings and reduction of levels.
- Plane Tabling: Equipment and methods used in plane table surveying.
- Contouring: Interpretation and preparation of contour maps, Site modeling with total station, Exercises in setting out of building works.
- Theodolite Surveying: Theodolite, its temporary and permanent adjustment, measuring of magnetic bearings, horizontal & vertical angles, Theodolite traverse and balancing the closing error.

Application-

Through this course students will acquire practical knowledge on handling basic survey instruments including Chaining, Compass, Theodolite, Tachometry, Auto Level, Total Station and will have adequate knowledge to carryout Triangulation, Traversing and general field marking for various architectural projects and Location of site.

ETCE 254A	SOIL MECHANICS LAB	C 1

Course Objectives:

Students will able to identify physical and mechanical properties of soil in the field and laboratory settings. Student will be familiar with Laboratory test standards and procedures. This include preparing soil samples for testing, performing the test, collecting and analyzing data, interpreting the results and writing technical reports.

Course Outcomes:

Students who successfully complete this course will be able to:

1. Perform common soil tests to identify physical and mechanical properties of soils.

2. Be familiar with soil mechanics tests and determines which test is needed in designing civil engineering projects and/or DepartmentSyllabus solving engineering problems.
3. Prepare soil samples for testing, performing the test, collecting and analyzing data.

4. Apply the laboratory results to problem identification, quantification, and basic soil mechanics related design problem.
5. Demonstrate the ability to write clear technical lab reports.

6. Use word processors and other modern software packages in writing and finishing the report.

Applications:

1. After completing the course students will be able to identify the soil types.

2. Ability to perform different types soil testing.

3.Ability to Explain Operation and Maintenance procedures of equipment used in soil testing.

ETCE254A	SOIL MECHANICS LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Visual Soil Classification and water content determination.
2. Determination of specific gravity of soil solids.
3. Grain size analysis-sieve analysis.
4. Liquid limit and plastic limit determination.
5. Field density by:
   - Sand replacement method
   - Core cutter method
6. Proctor`s compaction test.
7. Coefficient of permeability of soils.
8. Unconfined compressive strength test.
9. Direct shear test on granular soil sample.
10. Unconsolidated Undrained (UU) triaxial shear test of fine-grained soil sample.

REFERENCE BOOKS:

1. Soil Testing for Engineers by S. Prakash, PK Jain, Nem Chand &Bros., Roorkee.
2. Engineering Soil Testing by Lambi, Wiley Eastern.
3. Engineering Properties of Soils and their Measurement by J.P.Bowles, McGraw Hill.
4. Soil Engineering in Theory and Practice, Vol. II, Geotechnical Testing and Instrumentation by Alam Singh, CBS Pub.

SEMESTER V

ETCE 401A	HYDROLOGY	C
		3

Course Objective:

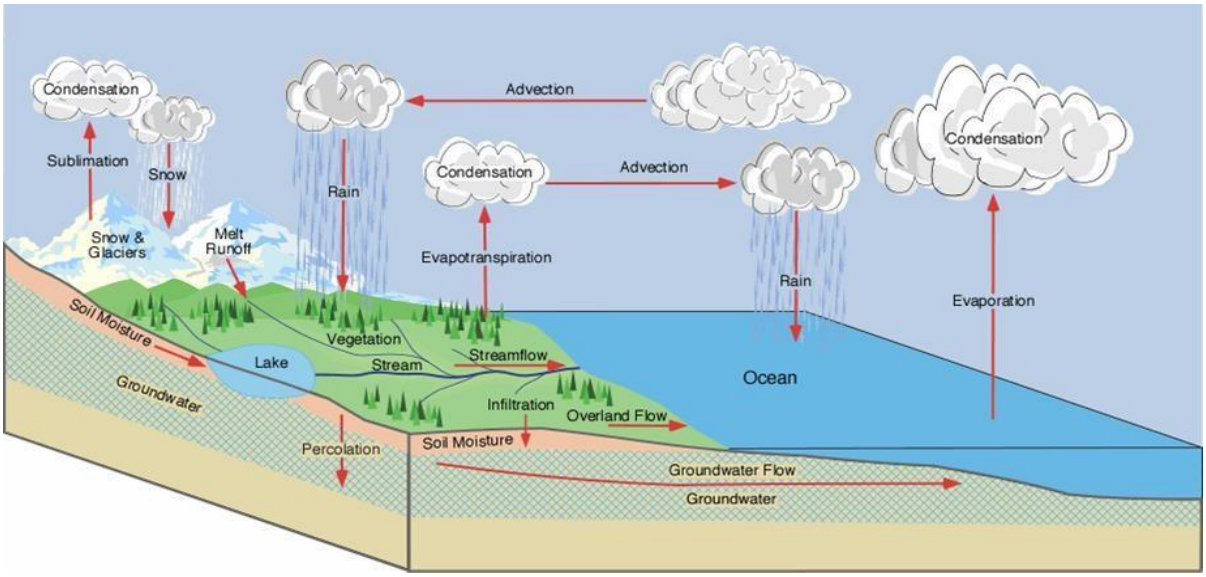
This course deals with various concepts of water resources engineering. The course introduces the concept of hydrology like hydrological cycle, Hydrological processes like precipitation, infiltration, evaporation, groundwater and runoff ground water and then deals with irrigation engineering.

Course Outcome:

The student will able to understand the concept of hydrological cycle and the water balance, Basic knowledge on hydrological processes in water balance studies as well as basic knowledge of computation and measurements, and some knowledge on data sources and data analysis. The course focuses on quantitative hydrology.

Applications:

Hydrology is used to find out maximum probable flood at proposed sites e.g. Dams. The variation of water production from catchments can be calculated and described by hydrology. Engineering hydrology enables us to find out the relationship between a catchment's surface water and groundwater resources. It helps us to know the required reservoir capacity to assure adequate water for irrigation or municipal water supply in droughts condition. It tells us what hydrologic hardware (e.g. rain gauges, stream gauges etc) and software (computer models) are needed for real-time flood forecasting. Used in connection with design and operations of hydraulic structure. Used to assess the reservoir capacity required to assure adequate water for irrigation or municipal water supply during drought.



ETCE401A	HYDROLOGY	L	T	P	C
		3	-	-	3

Course Objective: This course deals with various concepts of water resources engineering. The course introduces the concept of hydrology, ground water and then deals with irrigation engineering. It also deals with design of dam.

UNIT I

Introduction: Hydrologic cycle, scope and application of hydrology to engineering problems,drainage basins and its characteristics, stream geometry, hypsometric curves.
Precipitation: Forms and types of precipitation, characteristics of precipitation in India, measurement of precipitation, recording and non-recordingrainguages, rainguage station, rainguagenetwork,estimation of missing data, presentation of rainfall data, mean precipitation, depth -area –durationrelationship, frequency of point rainfall, intensity - duration- frequency curves, probable max. precipitation.

UNIT II

Evaporation & Transpiration: Process, evaporimeters and empirical relationships, analyticalmethod, reservoir evaporation and methods of its control, transpiration, evapo-transpiration and itsmeasurement, Penman`s equation and potential evapo-transpiration.
Infiltration: Infiltration process, initial loss, infiltration capacity and measurement of infiltration,infiltration indices.

UNITIII

Runoff: Factor affecting run-off, estimation of runoff, rainfall-run off relationships, measurementof stage-staff gauge, wire gauge, automatic stage recorder and stage hydrograph, measurement of velocitycurrentmeters, floats, area velocity method, moving boat and slope area method, electromagnetic, ultrasonicand dilution methods of stream flow measurement, stage discharge relationship.
Hydrograph: Discharge hydrograph, components and factors affecting shape of hydrograph,effective rainfall, unit hydrograph and its derivation, unit hydrograph of different durations, use and limitations of UH, triangular UH, Snyder`s synthetic UH, floods, rational methods, empirical formulae,
UH method, flood frequency methods, Gumbel`s method, graphical method, design flood.

UNIT IV

Ground Water: Occurrence, types of aquifers, compressibility of aquifers, water table and its
effects on fluctuations, wells and springs, movement of ground water, Darcy`s law, permeability and itsdetermination, porosity, specific yield and specific retention, storage coefficient, transmissibility.
Well Hydraulics: Steady state flow to wells in unconfined and confined aquifers.

REFERENCES BOOKS:

1 Engineering Hydrology by K.Subramanya.
2 Hydrology by H.M.Raghunath.
3 Hydrology for Engineers by Linsely, Kohler, Paulhus.
4 Elementary Hydrology by V.P.Singh.

ETCE 301A	ESTIMATION & COSTING	C
		4

Course Objective:

1. Impart the knowledge of Estimating & Costing for Civil Engineering Structures.
2. Prepare and evaluate contract documents.

Course Outcomes:

1. Prepare quantity estimates for Buildings as per specifications.
2. Draft detailed specifications and work out Rate Analysis for all works related to civil engineering projects.
3. Ascertain the quantity of materials required for Civil engineering works as per specifications.
4. Prepare cost estimate and valuation of civil engineering works.
5. Prepare tenders & contract documents. Evaluate contracts and tenders in construction practice.

Course Applications:

After completion of subject students will

1. Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses
2. Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
3. Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
4. Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
5. Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
6. Be able to understand how competitive bidding works and how to submit a competitive bid proposal.

ETCE 301A	ESTIMATION & COSTING	L	T	P	C
		3	1	-	4

Course Objective: The objective of the course is to provide a brief knowledge of estimation and costing of the material used in construction.

UNIT I

Estimate:

Principle of estimation ,units ,item work ,different kinds of estimates, different methods of estimation ,estimation of materials in single room building ,two room building , multi storey buildings, with different sections of walls, foundation ,floors and roofs ,R.B and R.C.C works Plastering ,white washing ,Distempering and painting ,doors and windows ,lump sum items Estimates of canals , dams ,barrages, Hilly roads etc.

UNIT II

Specification of Works:

Necessity of specification types of specification, general specification, specification of bricks cement, sand, water, lime, reinforcement: detailed specification for earthwork, cement, concrete brickwork, flooring, D.P.C, R.C.C, cement plastering, white and color washing, distempering painting

UNIT III

Rate analysis

Purpose, importance and requirements of rate analysis, units of measurement preparation of rate analysis, procedure of rate analysis for items: Earth work, concrete works, R.C.C works, reinforce brick work, plastering, painting, finishing (white washing, distempering).

UNIT IV

Public Works Account

Tender and acceptance of tender, Ernst money, security money, retention money, measurement book, cash book, preparation, examination and payment of bills, first and final bills, administrative sanction, technical sanction. Billing –maintenance of muster ROLL, preparation of pay bill, measurement of work for payment of contractors, different types of payment –first &final, running advance and final payment, Valuation Purpose of valuation, principles of valuation depreciation, sinking fund, salvage& scrap value, valuation of a building –cost method, rental –return method.

Books

1. Dutta BN –Estimating &costing

2. Chakraborty –Estimate costing &specification in civil engg

3. Kohli&kohli –Atext book on estimating &costing (Civil) with drawings Ambala ramesh Publications.

4. Rangwala SC –Estimating &Costing –AnandCharotar Book Stall

ETCE 307A	DESIGN OF CONCRETE STRUCTURES-I	C
		4

Course Objective:

Design of concrete structures addresses the process on both at conceptual and at mathematical level. The course curriculum deals with the study of various design aspects of reinforced concrete structure that helps to keep the structure durable, sound and stiff. The students will learn the analysis and design of beam, slab, columns, foundation and designing methods.

Course Outcomes:

After completing the course student will be able to:

- Understand design philosophies, basic elements of structures.
- Understand reinforcing details and concreting.
- Basic principles of working stress and limit state methods.
- Design of columns and footings.
- Concept and design of retaining wall.

Course Applications:

A. Identify the functional role of design theory and assumptions and application of this knowledge to actual design problem.
B. Evaluate the effect of the environment on service life performance, properties and failure modes of concrete structure.
C. Designing of different structural components with their practical applications.

ETCE307A	DESIGN OF CONCRETE	L	T	P	C
		3	1	-	4

	STRUCTURES - I				

Course Objective: The objective of the course is to provide a brief knowledge of concrete technology, design of concrete mix, design of sections, columns and footings etc.

UNIT I

Elementary treatment of concrete technology: Physical requirements of cement, aggregate, admixture and reinforcement, Strength and durability, shrinkage and creep. Design of concrete mixes, Acceptability criterion, I.S. Specifications.

Design Philosophies in Reinforced Concrete: Working stress and limit state methods, Limit state v/s working stress method, building code, Normal distribution curve, characteristic strength and characteristics loads, design values, Partial safety factors and factored loads, stress -strain relationship for concrete and steel.

UNIT II

Working Stress Method: Basic assumptions, permissible stresses in concrete and steel, design of singly and doubly reinforced rectangular and flanged beams in flexure, steel beam theory, inverted flanged beams, design examples.

Limit State Method: Basic assumptions, Analysis and design of singly and doubly reinforced rectangular flanged beams, minimum and maximum reinforcement requirement, design examples.
Analysis and Design of Sections in shear, bend and torsion -Diagonal tension, shear reinforcement, development length, Anchorage and flexural bond, Torsional, stiffness, equivalent shear, Torsional reinforcement, Design examples.

UNIT III

Concrete Reinforcement and Detailing-Requirements of good detailing, cover to reinforcement, spacing of reinforcement, reinforcement splicing, Anchoring reinforcing bars in flexure and shear, curtailment of reinforcement.
Serviceability Limit State -Control of deflection, cracking, slenderness and vibrations, deflection and moment relationship for limiting values of span to depth, limit state of crack width, Design examples.

UNITIV

Columns and Footings-Effective length, Minimum eccentricity, short columns under axial compression, Uniaxial and biaxial bending, slender columns, Isolated and wall footings, Design examples.

Retaining Walls-Classification, Forces on retaining walls, design criteria, stability requirements, proportioning of cantilever retaining walls, counterfort retaining walls, criteria

for design of counterforts, design examples.

REFERENCES BOOKS:

1. Design of Reinforced Concrete Structures,P.Dayaratnam,Oxford& IBH Pub.,N.Delhi.
2. Reinforced Concrete-Limit State Design, A.K.Jain, Nem Chand & Bros.,Roorkee.
3. Reinforced Concrete, I.C.Syal&A,K,Goel, A.H,Wheeler&Co.Delhi.
4. Reinforced Concrete Design, S.N.Sinha, TMH Pub.,N.Delhi.
5. SP-16(S&T) Design Aids for Reinforced Concrete to IS:456, BIS, N.Delhi.
6. SP-34(S&T) Handbook on Concrete Reinforcement and Detailing`, BIS, N.Delhi.

ETCE 321A	ENVIRONMENTAL ENGINEERING-I	C
		4

Course Objective:

This course is designed to expose the students towards population forecasting methods for designing of a water treatment plant, designing of various unit operations, distribution network characteristics of water quality and waste management aspects giving practical insight towards analysis of qualitative and quantitative aspects of water.

Course Outcomes:

Students will be able to understand the processes and methods for design and operation of treatment systems for water and water distribution systems. The components of water treatment plant and collection systems, physical, chemical and biological characteristics of water, effluent water quality, disinfection and environmental hygiene.

Course Applications:

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

- Explain the need of water treatment.
- Explain the importance of water quality standards and parameters.
- Identify and explain the main physical, chemical and biological processes for water treatment.
- Explain and use the main design criteria for water treatment processes.
- Design basic treatment processes.
- Combine the different processes appropriately.
- Develop treatment plant layouts.
- Design of distribution network.

ETCE321A	ENVIRONMENTAL ENGINEERING-I	L	T	P	C
		3	1	-	4

Course Objective: This course covers the environment and its importance, management of water quantity and quality, treatment of water, water conveyance and distribution system.

UNIT I

Water Quantity: Importance and necessity of water supply scheme. Water demands and its variations. Estimation of total quantity of water requirement. Population forecasting. Quality and quantity of surface and ground water sources. Selection of a source of water supply. Types of intakes.

Water Quality: Impurities in water and their sanitary significance. Physical, chemical and bacteriological analysis of water, water borne diseases, water quality standards.

UNIT II

Water Treatment: Objectives, treatment processes and their sequence in conventional treatment

plant, sedimentation – plain and aided with coagulation. Types, features and design aspects. Mixing basinsand Flocculation units. Filtration – mechanism involved types of filters, slow and rapid sand filtration units (features and design aspects), Disinfection principles and aeration.

Other water treatment processes: Purification processes in natural systems, water softening, removal of taste and odour, advanced methods of water treatment, deflouridation, dissolved solids removal.

UNIT III

Water Conveyance System: Conveyance of water, Intake structures, Rising and Gravity system,

Dual systems, Pumping Systems and pumping stations,valves and appurtenances, pipe materials and pipe fitting, O&M and troubleshooting for conveyance system.

UNIT IV

Water Distribution System: Layout of Distribution system – Dead End system, Grid Iron system,Ring system, Radial system, their merits and demerits, Distribution Reservoir-

functions anddetermination of storage capacity, Water Distribution Network, analysis of distribution network, layout, capacity and pressure requirements, leak detection,Maintenance, Water supply in buildings and plumbing.

REFERENCES BOOKS:

1. Environmental Engineering and management by Suresh K Dhameja
2. Environmental Engineering, (A Design Approach) by Sincero and Sincero
3. Water supply and sanitary Engineering by B C Punmia
4. Waste water treatment by P.N. Modi.

ETCE 313A	ENGINEERING GEOLOGY AND ROCK MECHANICS	C
		3

Course Objective:

This course is an introduction to the basic concepts of Engineering Geology. It also introduces students to the main tools and methods of Engineering Geology and the problems (directly and indirectly) that can create the geological conditions in the construction of civil works. The course also makes an introduction on the appearance causes, and methods of response and management of geological risks. At the same time, it stimulates the development of a culture closely linked to environmental protection.

Course Outcomes:

After completing the course, the students will be able to:

1. Identify the main and most common igneous, sedimentary and metamorphic rocks encountered by foundations and construction.
2. Identify and define the main morphological and geological characteristics as shown on maps,
3. Analyze geological parameters important in geotechnical studies.
4. Establish and describe topographical and geological sections,
5. Identify potential geological hazards and various structures and ways of preventing and dealing with them

Course Applications:

- To understand issues concerning the geological basement and structure of a region
- To distinguish the characteristics of the most important geological formations and problems that may arise in the various public works.
- To describe and interpret the geological structures in the geological maps and cross sections.
- To assess and appropriately adjust the results of geological studyin order to secure construction and operation of a technical project.
- To receive, analyze and evaluate data and appropriately solve problems both technical and environmental.

ETCE 313A	ENGINEERING GEOLOGY AND ROCK MECHANICS	L	T	P	C
		3	1	-	4

Course Objective: This course deals with the definition, object, scope and sub division of geology.

UNIT I

Introduction: Definition, object, scope and sub division of geology, geology around us. The interior of the earth. Importance of geology in Civil Engineering projects.
Physical Geology: The external and internal geological forces causing changes, weathering and erosion of the surface of the earth. Geological work of ice, water and winds. Soil profile and itsimportance. Earthquakes and volcanoes.

UNIT II

Mineralogy and Petrology: Definition and mineral and rocks. Classification of important rock forming minerals, simple description based on physical properties of minerals. Rocks of earth surface, classification of rocks. Mineral composition, Textures, structure and origin of Igneous, Sedimentary and Metamorphic rocks. Aims and principles of stratigraphy.Standardgeological/ stratigraphical time scale with its sub division and a short description based on engineering uses of formation of India.
Structural Geology: Forms and structures of rocks. Bedding plane and outcrops Dip and Strike. Elementary ideas about fold, fault, joint and unconformity and recognition on outcrops.
Importance of geological structures in Civil Engineering projects.

UNIT III

Ground water geology- Hydrogeology, aquifers, water table, springs and Artesian well, aquifers, ground water in engineering projects. Artificial recharge of ground water, Elementary ideasof geological investigations. Remote sensing techniques for geological and hydrological survey andinvestigation. Uses of geological maps and interpretation of data, geological reports.

UNIT IV

Applied geology-Physio graphic division in India, Suitability and stability of foundation sites and abutments. Geological conditions and their influence on the selection, location, type and design of dams, reservoirs, tunnels, highways, bridges etc.
Landslides and Hill slope stability. Improvement of foundation rocks, precaution and treatment against faults, joints and ground water, retaining walls and other precautions. Geology and environment of earth.
Rock Mechanics-Geological formation of rocks, Structural Geology, Classification of rocks, Physico-mechanical properties of rocks, Laboratory and field tests, Stress-strain behavior, Failure criteria for intact rock and rock masses, Fracture mechanism, Rock support and reinforcement, Foundations on rock, Rock blasting.

REFERENCES BOOKS:

1 A Text Book of Geology by P.K.Mukherjee
2 Physical and General Geology by S.K.Garg
3 Engineering and General Geology by Prabin Singh
4 Introduction of Physical Geology byA.Holmes.
5. Goodman, R.E., 1989. Introduction to Rock Mechanics, John Wiley & Sons

ETCE357A	ENGINEERING GEOLOGY LAB	C
		1

Course Objective:

The student is introduced to basics of Geology genesis and characteristic of rocks. The objective is to provide a basic understanding of geology its effect on civil engineering structures. Students will acquire practical Knowledge on geology and on various types of rocks and minerals.

Course Outcomes:

Student will be able to:

1. Develop understanding on impact of geological features on civil engineering projects
2. Identify the problems associated with different geological features on civil engineering structures and suggest alternatives.
3. Understand the geological aspects of construction project.
4. Categorize rocks and minerals by their origin and engineering properties.
5. Apply geological principles to rock masses and discontinuities for use in engineering design e.g. rock slopes, foundation.

Course Applications:

1. Geological survey has been carries out in developing geological maps or models.
2. For determining the bearing capacity of soil.
3. Application of different rocks and minerals to be used as construction material, their properties and characteristics.
4. Geological mapping serves the way for identifying rocks and geological strata.
5. Identifying seismic zones.
6. Determining stability of slopes.
7. Determining water content, type of soil and type of rocks.

ETCE 357A	ENGINEERING GEOLOGY LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Study of Physical properties of minerals
2. Identification of rocks forming silicate and ore minerals
3. Recognition of rocks
4. Use of clinometers compass and Bruton compass for measurement dip and strike of formations.
5. Geological cross sections and study of geological maps.
6. Study of models of geological structures and out crops patterns of different types of rocks and land forms.

ETCE354A	ENVIRONMENTAL ENGINEERING LAB-I	C
		1

Course Objective:

The lab course provides an opportunity to collect and preserve water samples from different sources, conduct various tests on water quality parameters, perform experiments on selected lab scale treatment processes. The lab course also exposes the student to carryout analysis on qualitative analysis of water and suitability according to the drinking water standards.

Course Outcomes:

Student will be able to:

- Acquaint with precision and accuracy of analytical data and to appreciate rounding off to a significant value in the context of water quality parameters.
- Apply various methods of sample preservation and instrumental analyses on water samples.
- Plan and perform filtration experiments, understand the significance of break point chlorination and plot particle size distribution curve.
- Develop the skill of analyzing, interpreting and inferring the laboratory data.

Course Applications:

- To have knowledge of water quality characteristics of water sources including: Groundwater sources, Aquifers, Surface Water sources, Reservoir characteristics, Watersheds, Wells, Raw Water and Clear Well Storage.
- Ability to describe the purpose and operational steps of key water treatment processes used to improve water quality Identify and explain the main physical, chemical and biological processes for water treatment.
- Ability to Explain Operation and Maintenance procedures of equipment used in water treatment plants and processes.

ETCE354A	ENVIRONMENTAL ENGINEERING	L	T	P	C
		-	-	2	1

	LAB-I				

LIST OF EXPERIMENTS

1. Determination of turbidity, color and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine.
5. Determination of most probable number of coliforms.
6. Measurement of air pollutants with high volume sampler.
7. Measurement of sound level with sound level meter.
8. Determination of total suspended and dissolved solids.
9. Determination of BOD.
10. Determination of COD.
11. Determination of kjeldahl nitrogen.
12. Determination of fluoride.

ETCE 358A	**SURVEY CAMP**	**C**
		2

Survey Camp will be of two weeks duration at the end of Fourth Semester during summer break and the evaluation will be done at the end of Fifth Semester.

ETEC381 A	PRACTICAL TRAINING-I	L	T	P	C
		-	-	2	1

Practical training will be for minimum of 4 weeks duration at the end of 4th semester during summer break and evaluation (NUES) will be done at the end of 5th semester.

SEMESTER VI

ETCE 302A	DESIGN OF CONCRETE STRUCTURES-II	C
		4

Course Objective:

Design of concrete structures addresses the process on both at conceptual and at mathematical level. The course curriculum deals with the study of various design aspects of reinforced concrete structure that helps to keep the structure durable, sound and stiff. The students will learn the analysis and design of continuous beam, flat slab, curved beams, foundation and building frames.

Course Outcomes:

After completing the course student will be able to:

Define and design the components of flat slab, conditions under which flat slabs are provided.
Design continuous beam and one way and two-way slab and their practical applications.
Foundations: Types, components, application and design of various types of foundation using practical examples.
Analyze the concept of yield line theory and applications of pre-stress concrete.

Course Applications:

A. Identify the functional role of design theory and assumptions and application of this knowledge to actual design problem.
B. Evaluate the effect of the environment on service life performance, properties and failure modes of concrete structure.
C. Designing of different structural components with their practical applications.

ETCE 302A	DESIGN OF CONCRETE STRUCTURE-II	L	T	P	C
		3	1	-	4

Course Objective: The objective of this course is to provide a detailed knowledge of continuous beams, flat slabs, foundations, building frames with design examples etc.

UNIT I

Continuous Beams-Basic assumptions, Moment of inertia, settlements, Modification ofmoments, maximum moments and shear, beams curved in plan-analysis for torsion, redistribution ofmoments for single and multi-span beams, design examples.

One way and Two Ways Slabs -General considerations, Design of one wayand two ways slabs for distributed and concentrated loads, Non-rectangular slabs,openings in slabs, Design Examples.

Staircases - Design of various types ofstaircases, design examples.

UNIT II

Foundations-Combined footings, raft foundation, design of pile cap and piles, under reamedpiles, design examples.

Water Tanks, Silos and Bunkers-Estimation of Wind and earthquake forces, design requirements, rectangular and cylindrical underground and overhead tanks, Intze tanks, design considerations, design examples. Silos and Bunkers-Various theories, Bunkers with sloping bottoms and with high sidewalls, battery of bunkers, design examples. '

UNIT III

Prestressed Concrete-Basic principles, classification of pre-stressed members, various prestressingsystems, losses in pre-stress, initial and final stress conditions, analysis and design of sectionsfor flexure and shear, load balancing concept, IS Specifications.

End blocks-Analysis of stresses, Magnel's method, Guyon's method, Bursting and spalling stresses,

design examples.

Building Frames-Introduction, Member stiffnesses, Loads, Analysis for vertical and lateral loads, Torsionin buildings, Ductibility of beams, design and detailing for ductility, design examples.

UNITIV

Yield Line Theory-Basic assumptions, Methods of analysis, yield line patterns and failuremechanisms, analysis of one way and two way rectangular and non-rectangular slabs, effect of topcorner steel in square slabs, design examples.

REFERENCES BOOKS:

1. Plain and Reinforced Concrete, Vol.2, Jai Krishna &O.P.Jain, Nem Chand & Bros.,Roorkee.
2. Pre-Stressed Concrete, N.Krishna Raju, TMH Pub.,N,Delhi.
3. Design of Prestressed Concrete Structure^, T.Y.Lin, John Wiley & Sons, N.Delhi.
4. Reinforced Concrete-Limit Stage Design, A.K.Jain, Nem Chand & Bros.,Roorkee.
5. IS 1343-1980.IS Code of Practice for Pre-stressed Concrete.
6. IS 3370-1976(Part 1 to IV), Indian Standard Code of Practice for Liquid Retaining Structures.
7. IS 456-2000, Indian Standard of Practice for Plain and Reinforced Concrete.

ETCE 364A	IRRIGATION ENGINEERING	C
		4

Course Objective:

To teach the basic concepts of irrigation and construction of various hydraulic structures. To introduce students to basic concepts of water, plants, their interactions, as well as irrigation and drainage systems design, planning and management. The structures involved the elementary hydraulic design of different structures and theconcepts of maintenance shall also form part. To develop analytical skills relevant to the areas mentioned above, particularly the design of irrigation and drainage projects.

Course Outcome:

On the completion of the course students will be able to understand: Concepts of irrigation and different hydraulic structures. How to estimate the quantity of water required for different types of crops.Be able to plan and design irrigation projects. Design channels and other irrigation structures required for irrigation, drainage, soilConservation, flood control and other water-management projects.

Applications:

With the help of appropriate irrigation system crop yield increases, it protects from famine, superior crops can be cultivated, problem of mix cropping can be eliminated, Economic development increases, Hydro power generation as well as Domestic and industrial water supply can be regulated.

ETCE 364A	IRRIGATION ENGINEERING	L	T	P	C
		3	1	-	4

Course Objective: Aim of this course is to introduce methods of irrigation, water requirement, canal irrigation and drainage works.

UNIT I

Introduction: Introduction, types and methods of irrigation.

Water Requirement of Crops:

Soil-moisture-irrigation relationship, depth and frequency of irrigation, irrigation efficiencies, consumptive use and its determination, duty and delta relationship, factors affecting duty, crop seasons.

UNIT II

Canal Irrigation: Canal irrigation system, canal alignment, canal losses, estimation of design discharge of a canal, design of stable channels by Lacey's and Kennedy's theory, Water logging- Effects, causes and remedial measures, land drainage, design of tile drains.

Canal Headworks: Layout and component parts of a diversion headwork scheme and their design considerations, sediment control in canals.
Design of Hydraulic Structures: Types, considerations in design, causes of failure of hydraulic structures founded on previous foundations, Bligh's creep theory and Khosla seepage theory, hydraulic jump and its applications in the design of hydraulic structures, design of a weir or barrage, design of a canal head regulator.

UNIT III

Canal Regulation Works: Canal falls, necessity, location, and types of falls, design of a vertical drop fall, and a glacis fall, roughening measures for energy dissipation, cross regulators and distributary's head regulators, canal escape.
Outlets: Canal outlets, requirement of a good outlet, types, criteria for judging the performance of outlets, design principle of open flume outlet and A. P. M. outlet.

UNIT IV

Cross Drainage Works: Need, types, selection of suitable CD work, design of CD works, design of transitions for canal waterway, uplift pressure on bottom floor of CD works.

TEXT BOOKS:

S.K. Garg: Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 13th Edition, New Delhi.

REFERENCE BOOKS

Fundamentals of Irrigation Engineering by Bharat Singh, 9th Edition, Nem Chand, Roorkee

ETCE 303A	GEOTECHNICAL ENGINEERING	C
		4

Course Objective:

1. Understand various properties of soil and their classification.
2. Understand various stresses and their distribution in soil and other engineering properties of soil.
3. Understand shear strength of soil and various techniques for improving the shear strength.

Course Outcome:

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

1. Characterize and classify soils.
2. Identify shear strength parameters for field conditions.
3. Compute and analyze the consolidation settlements.
4. Understand the principles of compaction and its control.

Applications:

After completion of course, students will be able toinvestigate subsurface conditions and materials, determine the relevant physical/mechanical and chemical properties of these materials, evaluate stability of natural slopes and man-made soil deposits, assess risks posed by site conditions.

ETCE303A	GEOTECHNICAL ENGINEERING	L	T	P	C
		3	1	-	4

Course Objective: The objective of the course is to provide a brief knowledge of geotechnical field problems, Characterization of ground, site investigations, foundations etc.

UNIT I

Stability of slopes

Causes of failure, factors of safety, stability analysis of slopes-total stress analysis, effective stress analysis, stability of infinite slopes types of failures of finite slopes, analysis of finite slopes-mass procedure, method of slices, effect of pore pressure, Fellinius method to locate center of most critical slip circle, friction circle method, Tayler's stability number, slope

stability of earth dam during steady seepage, during sudden drawdown and during and at the end of construction.

UNIT II

Braced Cuts

Depth of unsupported vertical cut, sheeting and bracing for deep excavation, movements associated with sheeting, and bracing, modes of failure of braced cuts, pressure distribution behind sheeting.

Cofferdams

Introduction, types of cofferdams, design and lateral stability of braced cofferdams, design data for Cellular cofferdams, stability analysis of cellular cofferdams on soil and rock, inter-lock stresses.

UNIT III

Cantilever Sheet Piles

Purpose of sheet piles, cantilever sheet piles, depth of embedment in granular soils-rigorous method Simplified procedure, cantilever sheet pile, penetrating clay, limiting height of wall.

Anchored Bulkheads

Methods of design, free earth support method in cohesionless and cohesive soils, fixed earth support method in cohesionless soils-Slum's equivalent beam method.

UNIT IV

Soil Stabilization

Soil improvement, shallow compaction, mechanical treatment, use of admixtures, lime Stabilization cement stabilization, lime fly ash stabilization, dynamic compaction and consolidation, bituminous stabilization, chemical stabilization, pre-compression, lime pile and column, stone column, grouting reinforced earth.

Basics of Machine Foundations

Terminology, characteristics elements of vibratory systems, analysis of vibratory motions of single decree freedom system-undamped free vibrations, undamped forced vibrations, criteria for satisfactory action of a machine foundation, degrees of a freedom of a block foundation, Barken's soil spring constant, Barken's method of a determining natural frequency of a block foundation subjected to vertical oscillations.

TEXT BOOKS:

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering

REFERENCES BOOKS:

1. Alam Singh – Modern Geotechnical Engineering
2. Brij Mohan Das – Geotechnical Engineering, CENGAGE Learning
3. I.H. Khan – Text Book of Geotechnical Engineering
4. C. Venkataramaiah – geotechnical Engineering
5. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics
6. G.V. Rao & G.V.S.S. Raju – Engineering with Geosynthetics.

ETCE 322A	ENVIRONEMTNAL ENGINEERING II	C 4

Course Objective:

To introduce students to the principles of wastewater and solid waste treatment and management. The students will learn the fundamental concepts in wastewater treatment technologies, hazardous solid waste disposal and management issues related to sludge treatment and disposal. This will also be combined with the process design skills related to both wastewater treatment and sewerage systems.

Course Outcomes:

Students will be able to understand the processes and methods for design and operation of treatment systems for wastewater and waste water collection systems, including stormwater. The components of sewerage system and collection systems, composition of wastewater, effluent water quality, disposal and environmental hygiene, process theory for wastewater, and selected methods for treatment of wastewater.

Course Applications:

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

- Explain the need of wastewater treatment.
- Explain the importance of effluent disposal and discharge standards.
- Identify and explain the main physical, chemical and biological processes for wastewater treatment.
- Explain and use the main design criteria for wastewater treatment processes.
- Design basic treatment processes.
- Combine the different processes appropriately.
- Develop treatment plant layouts.

ETCE322A	ENVIRONMENTAL ENGINEERING-II	L	T	P	C
		3	1	-	4

Course Objective: Definition and Scope, types of sewer pipes and their laying and testing.

UNIT I

Sewerage system: Generation and Estimation of Community Sewage; Flow variations; Storm Water flow; Flow measurement in open channels; Alternate systems for sewage collection and conveyance; Drains and sewers types; Sewer appurtenances; Construction and Maintenance of sewers; Sewage pumping and pumping stations; Design, Operation and maintenance of sewerage systems.

UNIT II

Characterization of sewage: Parameters for characterization; Sampling, testing and analysis of sewage; Relative stability and population equivalent; BOD and BOD kinetics.
Treatment of sewage: Basic principles of sewage treatment; Introduction to unit operations and processes - primary treatment units such as screening, grit chamber, Floatation units; Sedimentation tanks, secondary treatment units such as different types of aerobic suspended and attached growth systems, and tertiary treatment for polishing, nutrient removal and disinfection; Sludge Handling and disposal – thickening, stabilization, dewatering, drying and disposal.

UNIT III

Sewage treatment units design: Design of grit chamber, primary and secondary clarifiers, ASP, TF, stabilization ponds and oxidation ponds

Treated effluent disposal: Disposal into surface water bodies; Reuse for irrigation and aqua culturing; Land disposal; Disposal through injection into groundwater; effluent standards.

UNIT IV

Low cost sanitation systems – Imhoff tanks, septic tank - soakage pit/soil absorption systems; stabilization ponds; macrophyte ponds; oxidation ponds; and constructed wetland systems.
Plumbing: Sewer connections for houses and buildings; Traps, sanitary fittings & fixtures, typical lay out for a residence.

TEXT BOOKS:

1. Garg S. K.; Environmental Engineering Vol. II, Khanna Publishers New-Delhi.
2. H. S Peavy, D. R. Rowe & George Tchobanoglous, “Environmental Engineering”, McGraw Hill International Ed.
3. Manual on sewerage and sewage treatment, Ministry of Urban Development, New Delhi.

REFERENCES BOOKS

1. P.N. Modi; Sewage Treatment and disposal & Waste Water Engineering, Standard Book House New-Delhi.
2. Metcalf & Eddy, "Wastewater Engineering- Treatment and Reuse," Tata McGraw Hill,
3. Clair N Sawyer & Perry L McCarty, G. F. Parkin, "Chemistry for Environmental Engineers", McGraw-Hill.
4. Standard Methods for the Examination of Water and Waste Water, American Public Health Association.

ETCE 316A	TRANSPORTATION ENGINEERING-I	C
		4

Overview:

To provide basic knowledge in transportation so that students can understand and be able to solve transportation related problems and design for highway mode of transportation with focus on highway users' characteristics, geometric and pavement design, traffic engineering, and transportation planning.

Expected Outcomes:

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

- Carry out surveys involved in planning and highway alignment
- Design the geometric elements of highways and expressways
- Carry out traffic studies and implement traffic regulation and control measures and Intersection design.
- Characterize pavement materials.
- Carry out test on pavement materials.

Applications:

- Recognition of the function and scope of Transportation Engineering.
- Identification of Driver, User, vehicle and Roadway characteristics and Analysis of interaction among the parameters.
- Review the effect of urban development on traffic systems.
- Preparation of preliminary and final plans for highways, drainage structures, municipal utilities, roadway lighting, traffic control devices and intelligent transportation systems.

ETCE316A	TRANSPORTATION ENGINEERING-I	L	T	P	C
		3	1	-	4

Course Objective: The objective of this course to have a basic understanding of various highway plans, highway alignment, surveys, tracks, tunnels in Transport Engineering.

UNIT I

Highway Plans, Highway Alignment and Surveys Main features of 20 years road development plans in India. Requirement of an ideal high way alignment. Factors affecting alignment, Surveys for high way alignments. Classifications of roads. Objectives of highway planning. Surveys.

UNIT II

Cross section elements and sight distance considerations. -Cross section elements, friction, carriage way, formation width, land width, Camber, IRC recommended values. Types of

terrain design speed, sight distance, stopping sight distance, overtaking sight distance, overtaking zones, intermediate sight distance, sight distance at inter sections, head light sight distance, set back distance. Critical locations for sight distance.

UNIT III

Design of horizontal and vertical alignments-Effects of centrifugal force. Design of super elevation. Providing super elevation in the field. Radiusofcircularcurves.Extrawidening.Type and length of transition curves.Gradient, types &values.Summitcurves and valley curves, their design criterions.Grade compensation on curves.Traffic characteristics and traffic surveys, road user and vehicular characteristics.Traffic studies such asvolume, speed and O & D studies. Parking and accident studies.Fundamental diagram of traffic flows.Level of service.PCU.

UNIT IV

High way materialsSub grade soil evaluation, CBR test, plate bearing test, desirable properties of aggregates, various tests,testing procedures and IRC/IS specifications for suitability of aggregates

Types of Bituminous materials.Bitumen,tar, Cut back,emulsions. Various tests, testing procedures and IRS/Is specifications for suitabilityof bituminous materials in road construction. Bituminous mix, desirable properties. Marshall method ofmix design.

REFERENCES BOOKS:

1. Highway Engg by S.K.Khanna& C.E.G. Justo, Nem Chand Bros., Roorkee.
2. Principles and Practice of Highway Engg. ByL.R.Kadiyali, Khanna Publishers, Delhi.
3. Principles of Pavement Design by Yoder,E.J&Witczak,M.W., John Wiley and Sons, USA.

ETCE 354A	**TRANSPORTATION ENGINEERING LAB-I**	**C** 1

Overview:

The study of transportation engineering lab enables the students in integrating laboratory work into the course learning versus allowing students to direct the learning independently.

The objective of this lab is to conduct all standardized tests to assess quality of highway materials and pavements. Like, Aggregate impact test, Attrition test, Penetration test for bitumen and other tests.

Expected Outcomes:

The student will be able to

- Identify engineering properties of aggregate.
- Identify the grade & properties of bitumen.
- Find out peak hour traffic & peak time for a given location on the road.
- Calculate design speed, maximum speed & minimum speed limits of a location through spot speed.
- Draw parking accumulation curve and find out parking duration & turnover of parking lot/stretch.

LAB EQUIPMENTS

ETCE354A	TRANSPORTATION ENGINEERING-I LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1 Flakiness and elongation test

2 Marshal Stability test

3 C B R Value test

4 Bulk density and Void test

5 Dorry Abrasion Test

6 Specific gravity tests

7 Solubility Test

8 Aggregate Hardness,Toughness,cementation,adhesiveness test

9 Shearing tests on soil

10 Aggregate Water absorption Test

ETCE 459A	CAD LAB	C 4

Course Objective:

- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic Auto Cad skills.
- Learn basic engineering drawing formats.
- Prepare the student for future Engineering positions.

Course Outcomes:

- Student's ability to perform basic sketching techniques will improve.
- Student's ability to use architectural and engineering scales will increase.
- Student's ability to produce engineered drawings will improve.
- Student's ability to convert sketches to engineered drawings will increase.
- Students will become familiar with office practice and standards.
- Students will become familiar with Auto Cad two dimensional drawings.

Course Applications:

CAD technology is used in the drafting and design of all types of buildings, from small residential types (houses) to the largest commercial and industrial structures (hospitals and factories). CAD enables designers to layout and develops work on screen, print it out and save it for future editing, saving time on their drawings.

ETCE459A	CAD LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

Working on design software STAAD PRO

1. To perform Overview of Structural Analysis and Design, Calculating Shear Force and Bending Moment values for various supports and load types Introduction, STAAD. Pro V8i & STAAD Editor
2. To perform RC Designer: Beam Design and Column design
3. To perform Staircase Design
4. To perform Foundation Design, I: Isolated Footing, Combined / Strip Footing.
5. To perform Foundation Design II: Mat Foundation and Pile Cap Design

ETCE 351A	GEOTECHNICAL ENGINEERING LAB	C
		1

Course Objective:

Provide Civil Engineering students with the basic knowledge to carry out investigations and to identify soils in Geotechnical Engineering practice.

Course Outcome:

1. Be able to perform and interpret direct shear tests and estimate shear strength parameters.
2. Be able to conduct and estimate shears strength of soils in unconfined compression.
3. Be able to perform and analyze constant head permeability tests.
4. Be able to conduct one-Dimensional compression tests and estimate settlement parameters.

Application:

On completion of this module, the student must be able to:

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

ETCE351A	GEOTECHNICAL ENGINEERING LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Sieve Analysis
2. Hydrometer Analysis
3. Liquid & Plastic Limit Tests
4. Shrinkage Limit Test
5. Proctor Compaction Test
6. Relative Density
7. In Situ Density – Core cutter & Sand Replacement
8. Permeability Test
9. Direct Shear Test
10. Auger Boring
11. Static Cone Penetration Test
12. Standard / Dynamic Cone Penetration Test

SEMESTER VII

ETCE 310A	FOUNDATION ENGINEERING	C
		3

Course Objective:

Foundation is an important component of any civil engineering structure which must be safe, stable, and economically designed. The course on Foundation Engineering provides the students necessary geotechnical engineering skills to analyze and design shallow and deep foundation systems under different loading and soil conditions.

Course Outcome:

Students will be able to understand

1. The earth pressures on foundations and retaining structures.
2. Analyze shallow and deep foundations.
3. Calculate the bearing capacity of soils and foundation settlements.
4. Understand soil exploration methods.

Applications:

After completion of subject student will be able to

1. Develop different soil exploration techniques to examine the properties of soil.

Able to analyze the stability of natural slopes safety and sustainability of the slopes, design of retaining structures, reinforced earth wall, etc.

3. Perceive knowledge to practice ground improvement techniques.
4. Perceive knowledge to design shallow and deep foundation.
5. Ability to analyze to calculate bearing capacity, earth pressure and foundation settlement.
6. Ability to distinguish foundations under loading.

ETCE 310A	FOUNDATION ENGINEERING	L	T	P	C
		3	-	-	3

Course Objective: This course deals with the introduction to modulus of sub grade reaction, types of foundations, soil stabilization, retaining walls etc.

UNIT I

Criteria for foundation choice, bearing capacity, total and differential settlement, tolerance for various types of structures. Interpretation of soil profile for design parameters like Modulus of compressibility, modulus of sub grade reaction, Poisson ratio etc.

UNIT II

Raft foundations for buildings and tower structures including effects of soil structure interaction and non-linearity, different types of rafts and, methods of analysis, precautions for construction of shallow foundations.

UNIT III

Pile foundations, types, method of installation codal practices for permissible loads under vertical and lateral loads, Diaphragm walls, design and construction, foundations for heavy structures., Well and Caisson foundations,

UNIT IV

Soil Stability

Retaining walls-Types Elements for design, construction of cantilever and counter fort retaining walls. Unbraced excavations, Braced excavations. Sheet Piles and Bulkheads-Types and design of cantilever and Anchored sheet piles; Anchors and Tie backs.

Improvement of Foundation Soils

Purpose and Methods, a) Improvement of Granular Soils

b) Improvement of Cohesive soils

c) Grouting: Purpose, Functions Types of grouts and methods of injection.

d) Geo-synthetics: Types, Functions, Manufacturing of geo-textiles, Classification of geo-textiles.

TEXT BOOKS

1. Gopal Ranjan & Rao A.S.R.; Basic and Applied Soil Mechanics, New Age Publishers.
2. Murthy V.N.S.; A Text Book on Soil Mechanics and Foundation Engineering, C.B.S. Publisher.

REFERENCES BOOKS:

1. J. E. Bowles, Foundation Analysis and Design, McGraw Hill.
2. Cheng Liu & Jack B Evett; Soils and Foundations, Prentice-Hall Inc., USA.
3. Singh Alam; Modern Geotechnical Engineering, C.B.S Publishers.

ETCE 403A	DESIGN OF STEEL STRUCTURE - I	C
		4

Overview:

Design of Steel Structure - I will provide an understanding about the behavior of different types of steel structures and their connections used in construction like riveted, bolted and welded connections. Students will investigate the behavior of connections in various types of steel structures design exercises, case studies, and load testing of connections. Students will design steel beams and tension members and will gain an appreciation of the importance of structural design today, with an emphasis on environmental impact of large-scale construction.

Objectives & Expected Outcomes:

To strengthen the students' knowledge about fundamental structural forces in steel and the methods of to introduce to the forces acting on tension and compression members.

Introduction: Properties of structural steel. I.S.Rolled sections and I.S. specifications.
Connections: Importance, various types of connections, simple and moment resistant, riveted, bolted and welded connections.
Design of Tension Members: Introduction, types of tension members, net sectional areas, design of tension members, lug angles and splices.
Column Bases and Footings: Introduction, types of column bases, design of slab base and gusseted base, design of gusseted base subjected to eccentrically loading, design of grillage foundations.
Design of Beams: Introduction, types of sections, general design criteria for beams, and design of laterally supported and unsupported beams, design of built up beams, web buckling, web crippling and diagonal buckling.
Gantry Girders: Introduction, various loads, specifications, design of gantry girder

Plate Girder: Introduction, elements of plate girder, design steps of a plate girder, necessity of stiffeners in plate girder, various types of stiffeners, web and flange splices (brief introduction), Curtailment of flange plates, design beam to column connections: Introduction, design of framed and seat connection.

Expected Outcomes-

The course curriculum will make students load carrying capacity of various connections, design of beams, gantry girders and plate girders used in the construction practices. The outcome of the course will make students capable enough to design steel structures for construction purposes.

ETCE 403A	DESIGN OF STEEL STRUCTURE-I	L	T	P	C
		3	1	-	4

Course Objective: The course covers the properties of structural steel, design of tension and compression members etc.

UNIT I

Introduction: Properties of structural steel. I.S.Rolled sections and I.S. specifications.
Connections: Importance, various types of connections, simple and moment resistant, riveted, bolted and welded connections.
Design of Tension Members: Introduction, types of tension members, net sectional areas, design of tension members, lug angles and splices.

UNIT II

Design of Compression Members: Introduction, effective length and slenderness ratio, various types of sections used for columns, built up columns, necessity, design of built up columns, laced and battened columns including the design of lacing and battens, design of eccentrically loaded compression members.
Column Bases and Footings: Introduction, types of column bases, design of slab base and gusseted base, design of gusseted base subjected to eccentrically loading, design of grillage foundations.

UNIT III

Design of Beams: Introduction, types of sections, general design criteria for beams, design of laterally supported and unsupported beams, design of built up beams, web buckling, web crippling and diagonal buckling.
Gantry Girders: Introduction, various loads, specifications, design of gantry girder.

UNIT IV

Plate Girder: Introduction, elements of plate girder, design steps of a plate girder, necessity of stiffeners in plate girder, various types of stiffeners, web and flange splices (brief introduction), Curtailment of flange plates, design beam to column connections: Introduction, design of framed and seat connection.

REFERENCES BOOKS:

1. Design of steel structures, A.S.Arya&J.L.Ajmani, Nemchand& Bros., Roorkee.
2. Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
3. Design of steel structures, S.M.A.Kazmi&S.K.Jindal, Prentice Hall, New Delhi.
4. Design of steel structures, S.K.Duggal, TMH Pub, New Delhi.

ETCE 417A	GROUND WATER DEVELOPMENT	C
		4

Course Learning Objectives:

The course is designed to

- Appreciate groundwater as an important natural resource.
- Understand flow towards wells in confined and unconfined aquifers.
- Understand the principles involved in design and construction of wells.
- Create awareness on improving the groundwater potential using various recharge techniques.
- Know the importance of saline water intrusion in coastal aquifers and its control measures.
- Appreciate various geophysical approaches for groundwater exploration.
- Learn groundwater management using advanced tools.

Course Outcomes:

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

- Estimate aquifer parameters and yield of wells.
- Analyze radial flow towards wells in confined and unconfined aquifers.
- Design wells and understand the construction practices.
- Interpret geophysical exploration data for scientific source finding of aquifers.
- Determine the process of artificial recharge for increasing groundwater potential.
- Take effective measures for controlling saline water intrusion.
- Apply appropriate measures for groundwater management.

Applications: After completion of subject student will be able to find out

- The basic concepts of Estimate the surface runoff from given precipitation data.
- Design the appropriate rain water harvesting scheme and required structures for given conditions.
- To get concept of various surface and subsurface geophysical methods for groundwater explorations.
- To know about well hydraulics & design principles of well
- The concept for groundwater management and modeling.
- Ability to know about various surface and subsurface geophysical methods for

groundwater explorations.

- The groundwater management and modeling.

ETCE 417A	GROUNDWATER DEVELOPMENT	L	T	P	C
		3	1	-	4

Course Objective: At the end of this course, student will be able to evaluate groundwater resources using geophysical methods estimate aquifer parameters model regional groundwater flow and design water wells and design water wells

UNIT I

Types of aquifers, confined and un-confined aquifers, leaky – aquifers.
Geo-physical exploration studies.

UNIT II

Different types and procedures for analysis of geophysical studies
Well hydraulics, partial differential equations governing.

UNIT III

Groundwater flow in aquifers, estimation of aquifer parameters by different methods.
Steady groundwater flow analysis for multiwall systems, method of images.

UNIT IV

Groundwater movement, Darcy's law, Conductivity and Transmissivity, yield from a well under steady state conditions, Water well design, Well construction and maintenance procedures.

TEXT BOOKS:

1. Garg S.P. Groundwater and Tube Wells, Oxford and IBH Publishing Co. New Delhi, 2002.

REFERENCE BOOKS:

1. Raghunath H.M., 2002.Groundwater, New Age International Pub., New Delhi.
2. Todd, D.K., and Mays, L. W., Groundwater Hydrology, John Wiley & Sons, Singapore, 2011.

ETCE 308A	TRANSPORTATION ENGINEERING - II	C 4

Overview:

The objective of this course is:

- To know Pavement design process, pavement evaluation and performance, design alternatives, analysis, evaluation, selection and implementation.
- To introduce the concept of highway drainage.
- To know Economic evaluation of transportation projects, ownership financing of transport, economic function of transportation, road user and transportation cost, finance and taxation.
- To know the different components and methods of tunneling.

Expected Outcomes:

The student will be able to

- Understand Material properties, Design, Evaluation and Management of Pavement Systems.
- Understand different components of pavement structures.
- Understand latest design methods of flexible and rigid pavements.
- Carry out art of maintenance and Rehabilitation of Pavements.
- Have in-depth knowledge of the design and failures of the flexible and rigid pavements
- Analyze and evaluate transportation project case studies.

Application:

- Handle the planning, design, construction of rigid and flexible pavement.
- Estimate the transportation needs of the public and then secure the funding for projects.
- Effectively design drainage system for Highway.
- Carryout planning, designing and construction of tunnels.

ETCE 308A	TRANSPORTATION ENGINEERING-II	L	T	P	C
		3	1	-	4

UNIT I

Design of Flexible Pavements: Types of pavements. Flexible and rigid pavements. Design of thickness of a flexible pavement by Group Index method, CBR method (including latest IRC guidelines), Triaxial method and Burmister's method.

Design of Rigid Pavements: Westergaard's theory, critical locations of loading, load and temperature stresses. Critical combination of stresses.IRC guidelines for determination of

thickness of a rigid pavement. Joints: requirements, types, patterns. Spacing of expansion and contraction joints. Functions of dowel and tie bars.

UNIT II

Highway Construction: Non-Bituminous Pavements: Brief introduction to earthwork machinery: shovel, hoe, clamshell, dragline, bulldozers. Principles of field compaction of sub grade. Compacting equipments. Granular roads. Construction steps of WBM.
WMM. Construction of cement concrete pavements, Slip-form pavers, Basic concepts of the following: soil stabilized roads, use of geo-synthetics, reinforced cement concrete pavements, prestress concrete pavements, roller compacted concrete pavements and fiber reinforced concrete pavements.
Construction of Bituminous Pavements: Various types of bituminous constructions. Prime coat, tack coat, seal coat and surface dressing. Construction of BUSG, Premix carpet, BM, DBM and AC. Brief coverage of machinery for construction of bituminous roads: bitumen boiler, sprayer, pressure distributor, hot-mix plant, cold mix plant, tipper trucks, mechanical paver or finisher, rollers. Mastic asphalt. Introduction to various IRC and MOST specifications.

UNIT III

Highway Maintenance: Pavement failures. Maintenance operations. Maintenance of WBM, bituminous surfaces and cement concrete pavements. Pavement evaluation. Benkleman beam. Introduction to various types of overlays.
Highway Drainage and Hill Roads: Surface drainage: types, brief design. Types of sub-surface drainage. Special characteristics of hill roads: geometrics, hair pin bends, construction of hill roads, drainage of hill roads, maintenance problems of hill roads.

UNIT IV

Highway Economics and Finance: Need of economic evaluation. Highway user benefits and costs. Methods of economic evaluation: benefit cost ratio method, net present value method, internal rate of return method, comparison. Highway finance.
Tunnels: Sections of tunnels: advantages, limitations and suitability of each section. Shaft. Pilot tunnel. Driving tunnel in rocks: sequence of construction operations, full-face method, heading and bench method, drift method. Driving tunnels in soft ground: sequence of construction operations, needle beam method, shield tunneling, compressed air tunneling.

REFERENCES BOOKS:

1. Highway Engg by S.K.Khanna& C.E.G. Justo, Nem Chand Bros., Roorkee.

2. Principles and Practice of Highway Engg. byL.R.Kadiyali, Khanna Publishers, Delhi.

3. Principles of Pavement Design by Yoder,E.J&Witczak,M.W., John Wiley and Sons, USA.

4. Tunnel Engineering by S.C.Saxena, Dhanpat Rai Publications, N.Delhi.

5. A text book of Tunnel, Bridges and Railway Engg. byS.P.Bindra, Dhanpat Rai Delhi.

ETCE 411A	BRIDGE ENGINEERING	C
		3

Course Objectives:

- Introduction to bridge engineering.
- Historical background of bridges and types.
- Bridge aesthetics and proportioning.
- Design process.
- Review of applicable design codes.

- Loads on bridges and force distribution.
- Bridge geometry.
- Conceptual design.
- Analysis tools for highway and pedestrian bridges.
- Concrete and steel deck design.
- Design of substructures such as foundations with or without piles; abutments, retaining walls and wing walls; columns and cap beams; bearings.
- Introduction to reinforced concrete and prestress concrete principles.

Course Outcomes:

- To develop an understanding of and appreciation for basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality.
- To help the student develop an intuitive feeling about the sizing of bridge elements, i.e. develop a clear understanding of conceptual design.

- To understand the load flow mechanism and identify loads on bridges.
- To carry out a design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements.

Course Applications:

- Design the general picture of bridge engineering.
- Evaluation of bridge performance including the superstructure and substructure.
- Design of complicated structure system.
- Development of fundamental skills in bridge research.

ETCE 411A	BRIDGE ENGINEERING	L	T	P	C
		3	-	-	3

Course Objective: This course covers definition and components of bridge, investigations, specifications, construction, inspection and maintenance of bridges.

UNIT I

Introduction: Definition, components of a bridge, classifications, importance of bridges.

UNIT II

Investigation of Bridges: Need for investigations, selection of bridge site, preliminary data to be collected, design discharge and its determination, linear waterway, economical span, vertical clearance above HFL, scour depth, choice of bridge type

UNIT III

Standard Specifications: Road bridges, I.R.C. loadings, code provisions on width of carriageway, clearances, loads considered etc.

Slab type Bridges: Design of R.C.C. Orthogonal and Skew Culverts

Reinforced Concrete Bridges: T-Beam Bridge, Courbon's theory for load distribution. Balanced cantilever bridges, Pre-stressed concrete bridges (General discussions)

UNIT IV

Sub Structure: Types of piers and abutments, design forces, design of piers and abutments.

Bearing and Joints: Various types of expansion bearing and fixed bearings, elastomeric bearings, joints and their types, design of bearings

Construction, inspection and maintenance of bridges

TEXT BOOKS:

1. D. Johnson Victor; Elements of Bridge Engineering, Oxford and IBH Publishers, New Delhi.
2. Vazirani&Ratwani; BridgesDesign of Concrete, Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. Analysis, Design and Construction of Bridges by V.K. Raina, Tata McGraw Hill.
2. N. Krishna Raju, "Design of Bridges", Oxford and IBH.

ETCE 352A	TRANSPORTATION ENGINEERING LAB-II	C 1

Overview:

The objective of this course is:

- To learn the characteristics, properties and testing procedures of highway materials such as soil, aggregate and bitumen.
- This laboratory course will help the students to understand the theoretical concepts learned in the course transportation engineering II.

Expected Outcomes:

The student will be able to

- Understand the properties and the various test for the subgrade soil, road aggregates and the bitumen.
- Know the different types of bituminous pavement construction and its principles.
- Do Bituminous Mix design and will understand the fatigue behaviors of bituminous mixes.
- Perform superpave mix design and design the mix for the CC pavement and will know about the fillers in joints.
- Infer the suitability of the materials for construction of road.

ETCE352	TRANSPORTATION ENGINEERING-II LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Aggregate Impact Test.
2. Los-Angeles Abrasion Test on Aggregates.
3. Dorry's Abrasion Test on Aggregates.
4. Deval Attrition Test on Aggregates.
5. Crushing Strength Test on Aggregates.
6. Penetration Test on Bitumen.
7. Ductility Test on Bitumen.
8. Viscosity Test on Bituminous Material
9. Softening Point Test on Bitumen.

10. Flash and Fire Point Test on Bitumen.

ETCE 356A	FOUNDATION ENGINEERING LAB	C
		1

Course Objective:

Provide Civil Engineering students with the basic knowledge to carry out investigations and to identify soils in Foundation Engineering practice. To provide knowledge and ability to perform laboratory tests needed to determine soil design parameters.

Course Outcome:

Understand various aspects of foundation engineering including soil exploration, theories and design of various foundation components, retaining walls etc.

Estimate safe bearing pressure of different type of soils and rocks.
Design different foundation components.

Applications:

On completion of this module, the student must be able to: perform different types soil testing for safe bearing pressure as well as for rocks & able to explain operation and maintenance procedures of equipment used in soil testing.

ETCE356A	FOUNDATION ENGINEERING LAB	L	T	P	C
		-	-	2	1

LIST OF EXPERIMENTS

1. Determination of Relative density of coarse grained soils in dry and saturated conditions.
2. Determination of shear strength at different densities by Direct shear test.
3. Determination of MDD and OMC at different compactive effort by compaction test.
4. Determination of Unconfined compressive strength at different compactive effort.
5. Determination of compressibility characteristics of fine grained soils by Consolidation test.
6. Determination of bearing capacity by Standard Penetration test.
7. Determination of shear strength of dry sands by Tri-axial shear test.
8. Determination of shear strength of saturated sands by Tri-axial test.

9. Determination of bearing capacity by Plate load test.
10. Determination of bearing capacity by static and dynamic cone Penetration test.
11. Determination of bearing capacity by lab and field vane shear test.

ETCE 455A	MINOR PROJECT	C
		2

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports. This may be continuation of minor project-I or a new project.

ETEC 481A	PRACTICAL TRAINING-II	L	T	P	C
		-	-	2	1

Practical training will be for minimum of 4 weeks duration at the end of 6th semester during summer break and evaluation (NUES) will be done at the end of 7th semester.

SEMESTER VIII

ETCE 404A	EARTHQUAKE RESISTANT DESIGN	C
		3

Course Objective:

- To provide a coherent development to the students for the courses in sector of earthquake engineering.
- To present the foundations of many basic engineering concepts related earthquake Engineering.
- To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering.
- To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

Course Outcomes:

- The students will gain an experience in the implementation of Earthquake Engineering on engineering concepts which are applied in field Structural Engineering.
- The students will get a diverse knowledge of earthquake engineering practices applied to real life problems.
- The students will learn to understand the theoretical and practical aspects of earthquake engineering along with the planning and design aspects.

Course Applications:

- Calculate earthquake loading effect on structures.
- Design of structures against earthquake loading.
- Design of multi-story structure using different methods like Equivalent Static Lateral Load Method and Response Spectrum Method.

ETCE 404A	EARTHQUAKE RESISTANT DESIGN	L	T	P	C
		3	-	-	3

Course Objective: Aim of this course is to introduce the students to earthquake, theory vibrations, degree of freedom, physics which form the basis of all applied science and engineering.

UNTI I

Introduction: Nature of dynamic loads, earthquake, wind and blast loads, characteristics of dynamic problems, method of discretization etc.

UNTI II

Theory of Vibrations: Formulation of Equation of Motions: Free and forced vibrations of single degree of freedom systems, damping and its effects, transient vibration, response spectrum theory. Review of formulation of flexibility and stiffness matrices of framed structures, application of vibration theory.

UNIT III

Multi-degree of freedom systems: Mode shapes and frequencies, numerical techniques for finding modes shapes and corresponding frequencies, orthogonality relationship of principal modes, Determination of fundamental frequency, Rayleigh's principle and its applications, normal mode theory for forced vibration, analysis of multi-degree freedom system, and dynamic response by mode superposition method. Vibration of continuum system, free and forced vibration response.

UNIT IV

Introduction to Structural Failures due to Earthquake.

Introduction to IS: 1893 – 2002: Seismic analysis and design of OHSR's, framed structures by equivalent lateral load procedure and Modal analysis
Introduction to Ductile Detailing of Structures, Concept of Soft Story, Design of Shear Walls, IS:13920-1993.

Use of Codes with reference to Masonry Buildings like IS: 4326, IS: 13828, IS: 13827

TEXT BOOKS:

1. Paz Mario; Structural Dynamics (Theory and Computation), CBS Publishers and Distributors, 2nd edition.
2. Agarwal Pankaj and Shrikhande M.; “Earthquake Resistant Design of Structures” Prentice Hall of India

REFERENCE BOOKS:

1. Roy R. Carig, Jr: Structural Dynamics -An Introduction to computer methods, John Wiley & Sons.
2. R.W. Clough and J. Penzien, “Dynamics of Structures”, Second edition, McGraw Hill International edition.

ETCE 420A	RAILWAY ENGINEERING	C
		4

Course Objective:

The course will be an introduction to the railway engineering and rail infrastructures and their impacts on the society and on the environment. The course will focus on alignment, track geometry, superstructure and substructure components, switches, Railway planning and capacity, electro technical installations (power supply and signaling control system) together with operation and maintenance of railway.

Course Outcomes:

This course aims to provide students with grounding in the principles of railway engineering and operations, giving them a comprehensive understanding of:

The distinctive features of railway systems

The design and engineering of railway track and supporting infrastructure.
The design and engineering of railway rolling stock.
Key aspects of rail vehicle dynamics and the wheel-rail interface.
Principles and practice of railway signaling systems.
The railway timetabling process.
Railway station and interchange design.
Different models of organization, regulation and governance for rail systems.

The role of human factors in railway operations and safety.

Course Applications:

The candidate would have knowledge of:

Fundamental principles for railway engineering.
Basic track geometry parameters.
Railway superstructure and substructure components.
Operation and maintenance aspects of railway system.
Railway electro technical installations.
Environmental and societal impact of railway infrastructure.

ETCE 420A	RAILWAY ENGINEERING	L	T	P	C
		3	1	-	4

Students will choose from a list of subjects offered by Department as electives.

Course Objective: The objective of the course is to understand the importance of railway infrastructure planning and design, Identify the factors governing design of railway infrastructure and design and analyze the railway track system.

UNIT I

Introduction to Railways in India: Role of Indian Railways in National Development – Railways for Urban Transportation –LRT & MRTS. Alignment of Railway Lines: Engineering Surveys for Track Alignment – Obligatory points -Conventional and Modern methods (Remote Sensing, GIS & GPS, EDM and other equipments)

UNIT II

Permanent Way: Components and their Functions: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks Sleepers – Functions, Materials, Density – Functions, Materials, Ballast less Tracks.

Geometric Design of Railway Tracks: Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal/Vertical Curves.

UNIT III

Track maintenance and Rehabilitation: Points and Crossings - Design of Turnouts, Working Principles, Automated maintenance and upgrading.

Railway accidents: Human and system contribution to catastrophic accidents, Human Factors in Transport Safety, Unprotected level crossings, Safety Audit.

UNIT IV

Rolling Stock, Railway sections and yards: Re-laying of Track, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance, Level Crossings.

Signaling and Interlocking: Signaling, Interlocking and Track Circuiting - Construction & Maintenance.

TEXT BOOKS:

3. Chandra S. and M.M. Agarwal, Railway Engineering, Oxford University Press, New Delhi, India, 2007.

4. Saxena, S.C. and S.P. Arora, Railway Engineering, Dhanpat Rai and Sons, New Delhi, India, 1997.

REFERENCES BOOKS:

3. Rangwala, S.C., Principles of Railway Engineering, Charotar Publishing House, Anand, India, 1988.

ETCE 408A	DESIGN OF STEEL STRUCTURE - II	C
		4

Overview:

Design of Steel Structures-II will provide an understanding about the behavior of different types of steel structures, Students will design steel towers, industrial buildings, water tanks, plastic analysis and its design and will gain an appreciation of the importance of structural design today, with an emphasis on environmental impact of large-scale construction.

Objectives:

To strengthen the students' knowledge about fundamental structural forces in steel and the methods of analysis and calculations. To introduce to the forces acting on water tanks, towers, mists and industrial buildings.
Elementary Plastic Analysis and Design: Introduction, Scope of plastic analysis, ultimate load carrying capacity of tension members and compression members, flexural members, shape factor, mechanisms, plastic collapse, analysis, plastic analysis applied to steel beams and simple portal frames and design.
Industrial Buildings: Loads, general arrangement and stability, design considerations, design of purlins, design of roof trusses, industrial building frames, bracings and stepped columns.
Design of Water Tanks: Introduction, permissible stresses, design of circular, rectangular and pressed steel tanks including staging.
Design of Steel Stacks: Introduction, various loads to be considered for the design of steel stacks, design of steel stacks including foundation.
Towers: Transmission line towers, microwave towers, Design loads, classification, design procedure and specification.
Cold Formed Sections: Introduction and brief description of various type of cold-formed sections, local buckling, concepts of effective width and effective sections, elements with stiffeners, design of compression and bending elements.

Expected Outcomes:

The course curriculum will make students understand load carrying capacity of various industrial buildings, towers, water tanks and cold formed sections used in the construction practices. The outcome of the course will make students capable enough to design steel structures for construction purposes.

ETCE 408A	DESIGN OF STEEL STRUCTURE - II	L	T	P	C
		3	1	-	4

Course Objective: The course covers the analysis and design of structural steel, design considerations of industrial buildings, load calculations, design of compression and bending elements etc.

UNIT I

Elementary Plastic Analysis and Design: Introduction, Scope of plastic analysis, ultimate load carrying
capacity of tension members and compression members, flexural members, shape factor, mechanisms, plastic collapse, analysis, plastic analysis applied to steel beams and simple portal frames and design.

UNIT II

Industrial Buildings: Loads, general arrangement and stability, design considerations, design of
purlins, design of roof trusses, industrial building frames, bracings and stepped columns.
Design of Water Tanks: Introduction, permissible stresses, design of circular, rectangular and pressed steel tanks including staging.

UNIT III

Design of Steel Stacks: Introduction, various loads to be considered for the design of steel stacks,design of steel stacks including foundation.
Towers: Transmission line towers, microwave towers, Design loads, classification, design procedure
and specification.

UNIT IV

Cold Formed Sections: Introduction and brief description of various type of cold-formed sections,
local buckling, concepts of effective width and effective sections, elements with stiffeners, design of
compression and bending elements.

REFERENCES BOOKS:

1.Design of Steel Structures, A.S.Arya&J.L.Ajmani, Nem Chand & Bros., Roorkee.
2.Design of Steel Structures, P.Dayartnam, Wheeler Pub. Allahabad.
3.Design of Steel Structures, Gaylord & Gaylord, McGraw Hill, Newyork/International Students .
4.IS:800-1984, Indian Standard Code of Practice for General Construction in Steel.
5.IS-801-1975, Indian Standard Code of Practice for Use of cold-formed light gauge steel structural members in general building construction.

ETCE 415A	AIRPORT AND HARBOUR ENGINEERING	C
		4

Course Objective:

To have an overall knowledge of the structural components, design aspects, site investigation, planning and design of structural components of Airport and to understand the function of different components, navigation aids, traffics control related to Airports operations. As well

As to develop a knowledge and understanding of a wide range of port and harbor design and construction issues and of sustainable solutions in the port environment.

Course Outcomes:

After completion of the course, student will be

- Fix the orientation of the runways.
- Carryout the geometrical design of the airport infrastructure.
- Prepare structural designs of runway, taxiway, and apron-gate area.
- Prepare a plan of the airport terminal area.
- Introduce port and harbor engineering as a part of coastal and civil engineering.
- Equip students with knowledge of engineering applications at ports and harbors.
- Develop the ability to analyze relevant topics pertaining to port and harbor engineering.

Course Applications:

This course enables students to plan, prepares and supervises planning studies for improvements, redevelopment and expansion of the airport, public parking facilities, airport roadway systems, ground transportation systems, surveillance systems, checks on plans submitted by architects and contractors, oversees construction, and handles real estate and zoning problems. Students will also able to direct the maintenance of runways, taxiways, hangars, terminal buildings, and grounds.

Estimate and draw the land and water area of ports based on guidelines and analytical models. Design and dimension the external and internal port components based on guidelines and analytical equations. Explore and select construction methods of the port components based on best practices. Assess needs and propose methods for dredging.

ETCE 415A	AIRPORT AND HARBOUR ENGINEERING	L	T	P	C
		3	1	-	4

Students will choose from a list of subjects offered by Department as electives.

Course Objective: After completion of the course, student will be able to fix the orientation of the runways, carryout the geometrical design of the airport infrastructure, prepare structural designs of runway, taxiway, and apron-grate area and prepare a plan of the airport terminal area.

UNIT I

Air Transportation: Aircraft Characteristics - Landing gear configurations, aircraft weight, engine types, Aircraft performance characteristics: speed, payload and range, runway performance, declared distances, wingtip vortices.

UNIT II

Geometric Design of the Airfield - Airport classification: utility airports, transport airports, Runways: runway configurations, runway orientation, wind rose, estimating runway length, sight distance and longitudinal profile, transverse gradient, Taxiways and taxilanes: widths and slopes, taxiway and taxilane separation requirements, sight distance and longitudinal profile, location of exit taxiways, design of taxiway curves and intersections, end-around taxiways, Aprons: holding aprons, terminal aprons and ramps, surface gradients, Control tower visibility requirements.

UNIT III

Airport Lighting, Marking, and Signage - Requirements of visual aids, approach lighting system configurations, visual approach slope aids, threshold lighting, Runway and taxiway lighting and marking, airfield signage.

Terminal Area - Passenger terminal system and its components, Apron gate system: number of gates, gate size, aircraft parking type, apron layout, apron circulation, passenger conveyance to aircraft.

UNIT IV

Harbour Planning- Classification of Harbours, Major ports in India, Harbour components, characteristics of good Harbour and principles of Harbour planning, site selection criteria and layout of Harbours.

Harbour Design - General design aspects, breakwaters - function, types general design principles.

Harbour maintenance- Costal protection-purpose and devices, dredging, purpose, methods, dredgers-types, suitability, disposal of dredged materials. Mechanical and hydraulic dredgers.

TEXT BOOKS:

1. Khanna, S. K., Arora, M. G., and Jain, S. S. Airport planning and Design, Sixth Edition, Nem Chand and Bros, Roorkee, India, 2012.

ETCE 452A	MAJOR PROJECT	C
		4

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports. This may be continuation of minor project-I or minor project-II or a new project.