SYLLABUS

CIV111 **MATHEMATICS-I**

Lectures	: 5 Periods/week	Sessional Marks	: 30
Tutorial	: 1 Period/ week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Objectives:

- To introduce theory of matrices and solving system of linear equations
- To explain the role of Eigen values and Eigen vectors for orthogonal transformations.
- To impart knowledge of mean value theorems and series expansions.
- To explain the importance of partial differentiation and improper integrals.
- To describe the role of multiple integrals in calculating areas and volumes.

Course Outcomes:

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

- Solve system of linear equations in the engineering domains.
- Apply the functions of multiple variables to evaluate rate of change of physical quantities
- List/compare different types of mean value theorems.
- Apply improper integrals for estimating solving error functions.
- Evaluate the multiple integrals in Cartesian, Polar and Cylindrical coordinate systems.

UNIT I

Matrices:

Matrices: Rank – Echelon form – Normal form -Inverse of a matrix by Gauss-Jordan - Solution of Homogeneous linear systems – solution of Non-homogeneous linear systems – Gauss Elimination – Gauss Seidel methods. Eigen values – Eigen vectors – Properties – Cayley Hamilton theorem (without proof) – Inverse, Power of Matrix by Cayley Hamilton theorem — Reduction of quadratic form to Canonical form (Congruent transformation method, Orthogonal transformation) – Rank, Index, and Signature of a Quadratic form.

UNIT II

Mean value theorems:

Rolle's theorem - Lagranges mean value theorem - Geometrical interpretation - Cauchy's mean value theorem - geometrical interpretation - Taylor's theorem - Maclaurin's series.

Sequences and Series: Convergence and divergence – Ratio test – Comparison test – Integral test – Cauchy's root test – Alternate series – Leibnitz's rule.

UNIT III

Multivariable calculus:

Partial Differentiation Homogeneous function – Euler's theorem – Total derivative – Chain rule –Taylor's and Maclaurin's series – Expansion of Two variable functions – functional dependence – Jacobian – Maxima and Minima of functions of two variables without constraints and Lagrange's method of multipliers.

UNIT IV

Multiple Integrals

Double Integrals:

Double integrals, change of order of integration, double integration in polar coordinates, area enclosed by plane curves.

Triple Integrals :

Evaluation of triple integrals, change of variables between Cartesian, cylindrical.

UNIT V

Laplace Transforms:

Laplace transforms of standard functions – shifting theorems – transforms of derivative's and integrals – Unit step function – Dirac's delta function. Inverse laplace transforms - convolution theorem (without proof) – solving ordinary differential equations (Initial value problems) using Laplace transforms.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.

References:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3rd Edition, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13th Edition, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4th Edition, Pearson publishers, 2010.

CIV112 **ENGINEERING CHEMISTRY**

Lectures	: 5 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 3

Course Objectives:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement.
- compare the materials of construction for battery and electrochemical sensors
- explain the preparation, properties, and applications of thermoplastics & thermo settings, elastomers & conducting polymers.
- explain the principles of spectrometry, GC and HPLC in separation of gaseous and liquid mixtures

Course Outcomes

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

- demonstrate the corrosion prevention methods and factors affecting corrosion
- explain the preparation, properties, and applications of thermoplastics & thermosettings, elastomers & conducting polymers.
- explain calorific values, octane number, refining of petroleum and cracking of oils.
- explain the manufacturing of portland cement and concrete formation.
- explain the principles of spectrometry, GC and HPLC in separation of gaseous and liquid mixtures

UNIT I

Water Technology

Various impurities of Water, WHO guidelines, Hardness unit sand determination by EDTA method, water treatment for drinking purpose-sedimentation, coagulation, filtration (slow sand filter), various methods of chlorination, breakpoint chlorination.

Water treatment for industrial purpose: Boiler troubles, scales, sludges, caustic embrittlement, boiler corrosion, priming and foaming- causes and prevention, Internal conditioning -Phosphate, Calgon and Carbonate treatment, External conditioning-Lime Soda process (simple problems), softening by ion-exchange process, Desalination of Brackish water by Electro dialysis and Reverse osmosis.

UNIT II

Polymer Chemistry

Introduction to polymers, Functionality of monomers, chain growth and step growth polymerization, Co-polymerization (Stereo specific polymerization) with specific examples and mechanisms of polymer formation.

Plastics: Thermoplastics and Thermosetting, preparation, properties and applications of Bakelite, Elastomers, Preparation, properties and applications of BUNA-S and BUNA-N Rubbers.

Conducting Polymers- Introduction, examples, general applications and mechanism of Conduction on Poly acetylene.

Chemistry of Nano materials: Introduction to nano chemistry, preparation of nano materials - carbon nano tubes and fullerenes and their engineering applications.

UNIT III

Electro Chemistry And Applications

Electrodes-concepts, types of cells, electro chemical series, Nernst equation.

BATTERIES: Primary cell (Dry cell), Secondary cell (Lead-acid), Lithium batteries and their advantages, Fuel cell (H_2-O_2 cell).

Corrosion:

Types of corrosions- chemical corrosion, dry corrosion, electro chemical corrosion and wet corrosion, galvanic series, pitting and differential aeration of corrosion, factors affecting corrosion.

Corrosion control: Cathodic protection, Corrosion Inhibitors, Electro plating (Au) & (Ni).

UNIT IV

Instrumental Methods

Electromagnetic spectrum-Absorption of Radiation: Beer-Lambert's law-Principle and applications of Ultra-Violet, Infra-Red and Nuclear Magnetic Resonance Spectroscopy. Principle and applications of Gas Chromatography and HPLC Techniques.

UNIT V
Cement And Concrete Chemistry Introduction to Building Materials, Portland Cement, Constituents, Manufacturing Process, Setting and Hardening Cement. **Organic Reactions And Synthesis Of A Drug Molecule:** Introduction to reactions involving Substitution (SN1 and SN2), Elimination reactions (E1 and E2), Synthesis of commonly used drug molecule – Aspirin and Paracetmol.

Text Books

1. Engineering Chemistry, P.C. Jain and M. Jain - 6th Edition, Dhanapathi Rai & Sons, Delhi.
2. A text book of Engineering Chemistry, S.S. Dara – 12th Edition, S. Chand & Co. New Delhi
3. Engineering Chemistry, B.K. Sharma - Krishna Prakashan, Meerut (2001).
4. A text book of engineering chemistry, 3rd Edition, 2003, Shashi chawla, Dhanpat rai & Co
5. Instrumental methods of analysis, 7th edition, Gurudeep raj & Chatwal Anand , CBS Publications,1986.
6. Text book of Nano Science and Nano technology, B.S. Murthy and P. Shankar, University press.

Reference Books

1. Quantitative analysis - Day & Underwood.
2. A Text book of Instrumental methods, 7th edition, 2011 - Skoog and West.

CIV113 **PROFESSIONAL COMMUNICATION**

Lectures	: 5 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 3

Course Objectives:

1. To inculcate a sense of professionalism among the students while emphasizing on vocabulary building.
2. To adopt activity based teaching-learning methods to ensure that learners would be engaged in use of language.
3. To provide pertinent reading strategies for comprehension.
4. To impart effective strategies for sensible writing and demonstrate the same in briefing.

Course outcomes:

At the end of the course

1. The learners would be able to express their feelings using relevant vocabulary.
2. They can apply the use of cohesive devices for better reading comprehension.
3. Able to write appropriate structures on relevant topics.
4. Capable of framing proper sentences using grammatical structures and correct word forms.

UNIT I

Vocabulary Building

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.
1.5 One word substitutes and Idioms

UNIT II

Basic Writing Skills

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Organizing principles of paragraphs in documents

UNIT III

Identifying Common Errors in Writing

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions

UNIT IV

Nature and Style of Sensible Writing

4.1 Positive, Negative and Interrogative Sentences
4.2 Making Polite requests
4.3 Letter Writing: Format of a formal and Informal letters: writing formal letters and informal letters
4.4 Describing

UNIT V

Writing Practices

5.1 Reading Comprehension
5.2 Précis Writing
5.3 Essay Writing

Text Books:

1. *Academic writing: A handbook for International Students* Bailey, Stephen. . Routledge, 2014.
2. *Pathways: Listening, Speaking and Critical Thinking* Chase, Becky Tarver. . Heinley ELT; 2nd Edition, 2018.
3. *Skillful Level 2 Reading & Writing Student's Book Pack (B10),* Macmillan Educational.
4. *Practical English Usage*, Michael Swan. OUP. 1995.
5. *Remedial English Grammar* F.T. Wood., Macmillan.2007

Reference Books

6. *Study Writing*- Liz Hamp-Lyons and Ben Heasly., Cambridge University Press. 2006.
7. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad.
8. *Technical Writing* Sharon J.Gerson, Steven M.Gerson, , New Delhi: Pearson education, 2007.
9. *Communication Skills* Sanjay Kumar and Pushp Lata, , Noida: Oxford University Press, 2012.
10. *Word Power Made Handy* Dr. Shalini Verma, , S.Chand & Co Ltd., 2009.
11. *Objective English for Compititive Examinations* Hari mohan Prasad, Uma rani sinha, , New Delhi, Tata McGrraw-Hill P.Ltd, 2007.
12. *Communication Skills*- Meenakshi Raman, Sangeetha Sharma, , Oxford University Press, 2011.

CIV114 **ENGINEERING MECHANICS**

Lectures	: 5 Periods/week	Sessional Marks	: 30
Tutorial	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Objectives:

- knowledge of statics with emphasis on force equilibrium and free body diagrams.
- Provides an understanding of the kinds of stress and deformation
- how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions

Course Outcomes:

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

- Use scalar and vector analytical techniques for analyzing forces in statically
- determinate structures
- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
- Apply basic knowledge of maths and physics to solve real-world problems
- Understand measurement error, and propagation of error in processed data
- Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts)
- Understand basic dynamics concepts – force, momentum, work and energy;

UNIT I

Introduction to Engineering Mechanics- Force Systems, Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminancy

UNIT II

Friction- Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Basic Structural Analysis- Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines

UNIT III

Centroid and Centre of Gravity- Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

UNIT IV

Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

UNIT V

Particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy.Impulse-momentum (linear, angular); Impact (Direct and oblique).

Kinetics of Rigid Bodies- Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation

Text Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.

Reference Books:

1. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
2. Shanes and Rao (2006), Engineering Mechanics, Pearson Education.
3. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education.
4. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics.
5. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.
6. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.

CIV115 **COMPUTER PROGRAMMING WITH C**

Lectures	: 3 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 3

Course Objectives:

- Students will able to implement the algorithms & draw flowcharts for solving problems.
- Student will able to understand computer programming language concepts and code with branching & looping statements.
- Design modular programming & recursive solution formulation using the concept of functions and arrays.
- Ability to design well-structured programs with the concept of structures and pointers.

Course Outcomes:

• Understand the basic terminology used in computer programming
• Write, compile and debug programs in C language.
• Use different data types in a computer program.
• Design programs involving decision structures, loops and functions.
• Understand the dynamics of memory by the use of pointers
• Use different data structures and create/update basic data files.

UNIT I
Flowchart design through Raptor: Flow chart symbols, Input/ Output, Assignment, operators, conditional if, repetition, function and sub charts. Example problems(section 1) – Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers Example problems(section 2) - Fibonacci generation, prime number generation. Minimum, Maximum and average of n numbers.
UNIT II
C Basics: C-Basics: C-character set, Data types, Constants, Expressions, Structure of C program, Operators and their precedence & associatively, Simple programs in C using all the operators, Type casting ,type coercion.
UNIT III
Control Structures and Functions: Control Structures, Basic input and output statements, Preprocessor directives. Functions: Concept of a function, passing the parameters, automatic variables, scope and extent of variables, storage classes, recursion, iteration vs recursion, types of recursion, Simple recursive and non recursive programs, Towers of Hanoi problem.
UNIT IV
Arrays and Pointers: Arrays: Single and multidimensional Arrays, Character array as a string, string functions, Programs using arrays and string manipulation. Pointers: Pointers declarations, Pointer expressions, Pointer parameters to functions. Pointers, Pointers and array, Pointer arithmetic.
UNIT V
Structures and Files: Structures: Declaring and using structures, operations on structures, structures and arrays, user defined data types, pointers to structures. Command line arguments. Files: Introduction, file structure, file handling functions, file types, file error handling, Programs using file functions.

Text Books:

1. Programming in ANSI in C, E Balaguruswamy, 8th edition, (2019), Tata McGraw Hill
2. C Programming – Anitha Goel/Ajay Mittal/E.Sreenivasa Reddy -2nd edition (2016), Pearson India
3. Computer Concepts and Programming in C, R.S. Salaria, 1st edition (2016) Khanna Publishing

Reference Books:

1. https://raptor.martincarlisle.com/
2. Problem Solving with C- 2nd edition (2008) Somasekharan-PHI.
3. C Programming- Behrouz A forouzan – 3rd edition (2007) CENGAGE Learning
4. Let us C, Yashavant P. Kanetkar, 15th edition (2016) BBP Publications, Delhi.

CIV151 **ENGINEERING CHEMISTRY LAB**

Practicals	: 3 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 1.5

Course Objectives:

- Verify the fundamental concepts with experiments.
- To know the methods of determining hardness and chloride ion concentration of water sample.
- To determine Iron present in sample by Redox Titration and Potentiometric method.
- To know the molecular properties like Surface Tension and Viscosity.

Course Outcomes:

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

- Measure the strength of an acid by Conductometric method.
- Determine the physical properties like surface tension, adsorption and viscosity
- Estimate Iron in given sample by Redox Titration
- Calculate the hardness of water

LIST OF EXPERIMENTS

1. Determination of hardness of water by EDTA method
2. Estimation of Mohr's salt by Permanganometry
3. Estimation of Mohr's salt by Dichrometry
4. Determination of alkalinity of water
5. Percentage of purity of washing soda
6. Determination of available chlorine in bleaching powder
7. Preparation of Urea-Formaldehyde resin
8. Determination on strength of NaOH using HCl conductometry
9. Acid-Base titration by P^H meter
10. Acid-Base titration by Potentiometer
11. Determination of viscosity of lubricating oil
12. Determination of Surface tension

CIV152 **COMMUNICATION SKILLS LAB**

Practicals	: 3 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 1.5

List of Modules:

Module-1: **Phonetics**

a) Introduction to Phonetics
b) Vowels and Consonants
c) Accent, Intonation and Rhythm

Module-2: **Listening Comprehension**

a) Comprehending Spoken material in British English
b) Comprehending Spoken material in American English
c) Intelligent listening in situations

Module-3: **Every Day Situations: Conversation and Dialogues**

a) Introducing oneself & others
b) Asking for & giving permissions
c) Asking for and responding to give directions
d) Seeking request
e) Inviting and responding invitations
f) Apologizing

Module-4: **Interview Skills**

a) Introduction and Definition
b) Process of Interviews
c) Stress Interview
d) Technical Interview

Module-5: **Presentation Skills**

a) Extempore (JAM) Sessions
b) Group discussion
c) Identification of Source Material
d) Arrangement of Collected Data Elocution
e) Paper Presentation

Reference Books:

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems:

1. *Communicate to Conquer: A Handbook of Group Discussions and Job Interviews* with CD, PHI Publications.
2. *The ACE of Soft Skills: Attitude, communication and Etiquette for Success*, -Pearson Publications.
3. *Communication Skills2nd Edition* - LeenaSen, - PHI, 2007.
4. *Organizational Behavior 13th Edition*- Stephen P. Robbins and Timothy A. Judge, PHI, 2009.
5. *Business Communication* - Meenakshi Raman and Prakash Singh, Oxford Univ. Press, 2006.
6. *Communication Skills,* Sanjay Kumar and PushpLata, Oxford University Press, 2011.
7. *Word Power Made Handy* - Dr. ShaliniVerma, S.Chand& Co Ltd., 2009.
8. *Phonetics*-O'Connor, J.D., Penguin, Harmondsworth, 1984

CIV153 **COMPUTER PROGRAMMING LAB**

Practicals	: 3 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 1.5

Program- 1:

1. Construct flowcharts to

a. calculate the maximum, minimum and average of N numbers

b. develop a calculator to convert time, distance, area, volume and temperature from one unit to another.

c. calculate simple and compound interest for various parameters specified by the user

d. generate first N numbers in the Fibonacci series

Program- 2:

Write a program

a) Which determines the largest and the smallest number that can be stored in different data types of like short, int., long, float and double.

b) To find greatest of three numbers using conditional operator.

c) To swap two numbers with and without temporary variable.

d) Multiple unary increment and decrement operators in arithmetic expressions.

Program- 3:

Write a program

a) To find greatest of three numbers.

b) To find arithmetic operations using switch.

c) To count the digits of a number.

d) To check whether a number is perfect or not.

Program- 4:

Write a program

a) To check whether a number is strong or not.

b) To check whether a number is armstrong or not.

c) To check whether a number is palindrome or not.

d) To find the Fibonacci series upto the given number.

Program- 5:

Write a program

a) To swap two variables using functions.

b) To perform menu driven arithmetic operations using functions.

c) To find the factorial of a number using recursive and non- recursive functions.

d) To find the Fibonacci series using recursive functions.

e) To find the solution for towers of Hanoi using recursive function.

f) Pass parameters to a functions using call by value and call by reference.

Program- 6:

Write a program on Arrays

a) To read n numbers and sort them.

b) To find the minimum and maximum numbers.

c) To read two matrices and find their sum, difference and product of them.

Program- 7:

Write a program on strings

a) To demonstrate the use of string manipulation functions.

b) To sort the names in Alphabetical order.

Program- 8:

Write a program on pointers

a) To read dynamic array and sort the elements.

b) To perform pointer arithmetic.

Program- 9:

Write a program

a) To create student structure and read marks of three subjects and find the sum and total of the student.

b) for 60 students record using the above student structure.

c) To implement complex structure. Perform addition, subtraction and multiplication of two complex numbers.

Program- 10:

Write a program on Files

a) To append content of a file.

b) To display the content of a file.

c) To copy content of one file to other file.

d) To count the no of characters in a file.

e) To compare the contents of two files.

CIV121 **MATHEMATICS II**

Lectures	: 4 Periods/week	Sessional Marks	: 30
Tutorials	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Objectives:
- To introduce important features of differential equations and related methods
- To familiarize the techniques of solving partial differential equations arising in engineering
- To introduce the subject of vector calculus to the students.
- To make the students aware of the importance between mathematics and engineering.

Course Outcomes:
Student will able to
- Determine the solutions of ordinary differential equations by applying different methods.
- Solve the higher order differential equations apply the same to the real-world problems.
- Acquire the knowledge on partial differential equations wave, heat, Laplacian equations.
- Explain the physical interpolation of gradient, divergence and curl.
- Apply Green's, Stoke's, Gauss divergence theorems to evaluate double and triple integrals.

UNIT I

Linear Differential Equations of first and Higher Order:
Exact – Reducible to exact differential equations – Orthogonal trajectories – Newton's law of cooling – Law of exponential growth and decay.
Non homogeneous equations of higher order with constant coefficients with Right hand side terms of the type: e^{ax}, sin ax, cos ax, x^k, e^{ax} V(x) and x^m V(x).

UNIT II

Equations Reducible to Linear Differential Equations and Applications:
Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: L-C-R Circuit problems.

UNIT III

Partial Differential Equations and Applications:
Introduction, Formation of PDE, Solution of PDE, Linear equations of first order, Non-linear equations of first order.
Applications: Method of separation of Variables, One dimensional Wave, Heat equations and Laplacian equation.

UNIT IV

Vector Calculus: Vector differentiation:
Scalar and vector point functions, Del applied to scalar point functions. Gradient – Divergence – Curl – Vector identities.

UNIT V

Vector Integration:
Line integral – work done – Potential function – area – surface and volume integrals – Vector integral theorems (without proof) viz. Greens, stokes and Gauss divergence and related problems

Textbooks:
1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

References:
1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, 4/e, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.

CIV122 **ENGINEERING PHYSICS**

Lectures	: 3 Periods/week	Sessional Marks	: 30
Tutorials	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course objectives

- Introduce the fundamental concepts of wave optics
- Gain knowledge about the concepts of Acoustics and Ultrasonics
- Understand the principles of Quantum mechanics
- Familiarize the students with basic ideas of mechanics and elasticity

Course outcomes

The student will be able to

- Explain the basic concepts of optics, Acoustics, Ultrasonics, elasticity principles of physics in Mechanics and Quantum mechanics.
- Apply the concepts of Optics, mechanics, elasticity and Quantum mechanics to obtain required parameters
- Analyze the concepts of Interference, diffraction, mechanics, quantum mechanics, elastic nature of the materials and applications of ultrasonics
- Evaluate the wavelength of light using concepts of optics, quantum mechanics, different constant values of materials from elasticity and ultrasonic waves in the development of technology and appliances for improvement of society and people.

UNIT I

OPTICS

Principle of Superposition–Interference of light–Young's double slit Experiment–Interference in thin films by reflected light-Newton's Rings–Determination of Wavelength- Michelson Interferometer –Engineering applications

Diffraction–Fresnel Diffraction–Fraunhofer Diffraction –Single slit Diffraction–Diffraction Grating–Grating Spectrum –Determination of Wavelength–Engineering applications

UNIT II

ACOUSTICS AND ULTRASONICS

Classification of Sound–decibel- Weber–Fechner law–Sabine's formula-derivation using growth and decay method – Absorption coefficient and its determination –requirements of acoustics-factors affecting acoustics of buildings and their remedies.

Production of ultrasonic waves by piezoelectric method–Detection of ultrasonic waves by acoustic grating method–Non Destructive Testing–Pulse echo system through transmission and reflection modes–Different Types of scans in NDT(A,B and C)–Applications of ultrasonics

UNIT III

MECHANICS

Basic laws of vectors and scalars, rotational frames–conservative and non-conservative forces–F = gradV–Newton's laws in inertial and linear accelerating non-inertial frames of reference–rotating frame of reference with constant angular velocity–Harmonic oscillator; damped harmonic motion; Forced oscillations and resonance.

UNIT IV

PRINCIPLES OF QUANTUM MECHANICS

Introduction–Matter waves–de-Broglie's Hypothesis of matter waves–Properties of matter waves– Heisenberg's uncertainty principle–Schrodinger's time independent and time dependent wave equations– Physical significance of the wave function–Particle in one dimensional potential box.

UNIT V

ELASTICITY

Concepts of elasticity–plasticity–strain hardening–failure (fracture/yielding)–Idealization of one dimensional stress-strain curve–Generalized Hooke's law with and without thermal strains for isotropic materials; Elastic constants and their relationships–Strain energy–Bending of beams–Bending moment of a beam

TEXT BOOKS

1. Engineering Physics - Gaur R.K. and Gupta S.L.- Dhanpat Rai Publishers, 8th edition, 2012
2. A Text book of Engineering Physics - Dr.D. Thirupathi Naidu and M Veeranjaneyulu-V.G.S. Book Links, 1st edition, 2019
3. A Text book of Engineering Physics- M.N. Avadhanulu and P.G.Kshirsagar S. Chand Publications, 11th edition, 2017

REFERENCE BOOKS

1. Engineering Physics - D.K. Bhattacharya and A. Bhaskaran, - Oxford Publications- 1st edition, 2015
2. An introduction to Mechanics-II D. Kleppner and Robert Kolenkow -Cambridge University Press, 1st edition, 2015
3. Lectures on Physics - Richard P Feynman, Pearson Publishers, New Millennium Eds, 14th edition, 2011 .
4. Engineering Mechanics of solids –EP Popov, 2nd edition, 2002.

CIV123 **INTRODUCTION TO CIVIL ENGINEERING**

Lectures	: 3 Periods/week	Sessional Marks	: 30
Tutorials	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Learning Objectives

- to give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering
- to motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
- to expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

Course Outcomes:

- Introduction to what constitutes Civil Engineering
- Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering
- Highlighting the depth of engagement possible within each of these areas
- Exploration of the various possibilities of a career in this field
- Understanding the vast interfaces this field has with the society at large
- Highlighting possibilities for taking up entrepreneurial activities in this field
- Providing a foundation for the student to launch off upon an inspired academic pursuit

UNIT I

Basic Understanding: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career

History of Civil engineering: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers

UNIT II

National Planning for Construction and Infrastructure Development;

Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works;

Fundamentals of Architecture & Town Planning: Aesthetics in Civil Engineering,Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities

Fundamentals of Building Materials: Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes

UNIT III

Basics of Construction Management & Contracts Management: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management

Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction;

Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunnelling

Hydraulics, Hydrology &Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multipurpose reservoir projects

UNIT IV

Ocean Engineering: Basics of Wave and Current Systems; Sediment transport systems; Ports & Harbours and other marine structures

Power Plant Structures: Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects

Structural Engineering: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies;

Surveying & Geomatics: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR;

UNIT V
Traffic &Transportation Engineering: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples. **Repairs & Rehabilitation of Structures:** Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non Destructive testing systems; Use of carbon fibre wrapping and carbon composites in repairs. **Computational Methods, IT, IoT in Civil Engineering:** Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems.

Text Books:

1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2. The National Building Code, BIS, (2017)
3. RERA Act, (2017)
4. Building Materials by P.C. Varghese, PHI Learning pvt. Ltd, 2015
5. Surveying Vol 1 & 2 by B.C. Punmia, Laxmi Publications, 2005.
6. Soil Dynamics and Machine foundations by K.R.Arora.
7. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd edition. Professional Offset
8. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd edition, Avinash Publications Mumbai

Reference Books:

1. P. S. Narayan (2000), Intellectual Property Rights, Gogia Law Agency
2. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.
3. Basic Civil Engineering by P.C. Punmia, Laxmi Publications, 1st edition, 2003.

CIV124 **BASIC ELECTRICAL ENGINEERING**

Lectures	: 3 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 3

Course Learning Objectives:

- To learn the basic principles of electrical law's and analysis of networks.
- To understand the principle of operation and construction details of DC machines.
- To understand the principle of operation and construction details of transformer.
- To understand the principle of operation and construction details of alternator and 3- Phase induction motor.
- To study the operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
- To learn the operation of PNP and NPN transistors and various amplifiers.

Course Outcomes:

- Able to analyse the various electrical networks.
- Able to understand the operation of DC generators,3-point starter and conduct the Swinburne's Test.
- Able to analyse the performance of transformer.
- Able to explain the operation of 3-phase alternator and 3-phase induction motors.
- Able to analyse the operation of half wave, full wave rectifiers and OP-AMPs.
- Able to explain the single stage CE amplifier and concept of feedback amplifier.

UNIT I

DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

UNIT II

AC Circuits (10 Hours)

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

UNIT III

DC Machines & Transformers (12 Hours)

Construction and working of DC machine - EMF equation DC Generator- OCC characteristics of DC generator, Classifications of DC motor and their applications

Transformer - Ideal and practical transformers, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer.

UNIT IV

AC Machines (10 Hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic, starting and speed control of induction motor. Single-phase induction motor. Construction and working of synchronous generators.

UNIT V

Electrical Installations (10 Hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup

TEXT BOOKS:

1. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, 6th Edition, TMH, 2002.
2. A Sudhakar and Shyam Mohan SP, Circuits and Networks: Analysis and Synthesis, 4th Edition, TMH, 2010
3. Electrical Technology, B.L.Theraja & A.K.Theraja, Volume – I & II, 23rd edition, 1959.

REFERENCE BOOKS:

1. Electric Machines by I.J. Nagrath& D.P. Kothari, Tata Mc Graw – Hill Publishers, 4th edition, 2010
2. Fundamentals of Electric Circuits / Charles K. Alexander, Matthew N. O. Sadiku. — 5th edition, 2011.
3. Mahmood Nahvi and Joseph Edminister, Electric Circuits, 4th Edition, Schaum's outline series, TMH, 2004.
4. Electric Machinary-A.E. Fritzgerald, C. Kingsley &S. Umans, Mc Graw-Hill Companies, 6thediton 2003.

CIV125 **ENGINEERING GRAPHICS**

Lectures	: 2 Periods/week	Sessional Marks	: 30
Practicals	: 4 Periods/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Objectives

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Outcomes:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

UNIT I
Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales
UNIT II
Orthographic Projections: Principles of Orthographic Projections Conventions - Projections of Points and lines inclined to both planes; Projections of planes, inclined Planes - Auxiliary Planes
UNIT III
Projections of Regular Solids: those inclined to both the Planes, Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.
UNIT IV
Sections and Sectional Views of Right Angular Solids: Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)
UNIT V
Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., 53rd edition (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. 2nd edition (2009), Engineering Drawing and Computer Graphics, Pearson Education

Reference Books:

3. Agrawal B. & Agrawal C. M. 2nd edition (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah 23rd edition(2010), Text book on Engineering Drawing, Scitech Publishers

CODE: CIV161 **ENGINEERING PHYSICS LAB**

Practicals : 3 Periods/week
University Exam : 3 hours

Sessional Marks : 30
University Exam marks: 70
Credits : 1.5

Students have to do 10 experiments from the list given below

List of Experiments

1. Determination of thickness of fiber/paper/thin foil using wedge method
2. Determination of radius of curvature of plano-convex lens by Newton's rings method
3. Determination of wavelength by using plane diffraction grating
4. Determination of dispersive power of a Prism
5. Determination of the wavelength of Laser source
6. Determination of acceleration due to gravity by using Compound Pendulum.
7. Determination of frequency of A.C supply using Sonometer
8. Determination of moment of inertia of a Fly Wheel
9. Photo voltaic cell - Determination of fill-factor
10. Photo cell – I-V Characteristic curves and determination of stopping potential
11. Determination of ultrasonic velocity in liquid (Acoustic grating)
12. Determination of Rigidity modulus of material of wire-dynamic method (Torsional pendulum)
13. Determination of Y, η and K with Searle's Apparatus
14. Determination of Numerical Aperture of an optical fiber.
15. Series LCR resonance circuit - Determination of "Q" factor

CODE: CIV162 **BASIC ELECTRICAL ENGINEERING LAB**

Practicals	: 3 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 1.5

Any 10 Experiments must be performed

1. Study of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors, Fuses and MCB
2. Verification of Kirchoff's Laws
3. Verification of Thevenin's Theorem
4. Verification of Nortons Theorem
5. Verification of Superposition Theorem
6. Verification of Maximum power transfer theorem
7. Verification of reciprocity theorem
8. Open circuit characteristics of D.C shunt generator
9. Speed control of DC shunt motor
10. OC & SC tests on single - phase transformer
11. Load test on single Phase Induction Motor
12. Generation of Voltage from 3 Phases Synchronous Machine.

CODE: CIV163 **CIVIL ENGINEERING WORKSHOP LAB**

Practicals	: 3 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 1.5

LIST OF EXPERIMENTS

1. Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape only.
2. Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape and cross staff.
3. Construct a wall of height 50 cm and wall thickness 1½ bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm.
4. Construct a wall of height 50 cm and wall thickness 2 bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm.
5. Computation of Centre of gravity and Moment of inertia of a given rolled steel section by actual measurements.
6. Installation of plumbing and fixtures like Tap, T-Joint, Elbow, Bend, Threading etc;
7. Plastering and Finishing of wall
8. Application of wall putty and painting a wall
9. Application of base coat and laying of Tile flooring of one square meter
10. Preparation of soil cement blocks for masonry and testing for compressive strength
11. Casting and testing of Fly ash Blocks
12. Preparation of cover blocks for providing cover to reinforcement

MANDATORY COURSE

CODE: MC140 **DESIGN THINKING**

Lectures	: 4 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	: 0

Course Objectives:

- To bring awareness on innovative design and new product development.
- To explain the basics of design thinking.
- To familiarize the role of reverse engineering in product development.
- To train how to identify the needs of society and convert into demand.
- To introduce product planning and product development process.

Course Outcomes

- After completion of this course,
- the student will be able to summarize the importance of basic sciences in product development
- explain the historical developments in mechanical, electrical, communications and computational engineering
- apply systematic approach to innovative designs
- identify new materials and manufacturing methods in design

UNIT I
Science to Engineering: Job of engineers, engineering units and measurement, elements of engineering analysis, forces and motion, energy, kinematics and motion, conversion of linear motion to rotary and vice versa, motion transmission. Physics to Engineering: Application of Newton laws, Pascal's law, Bouncy, Bernoulli's theorem, Ohm's law, electrical induction in engineering products.
UNIT II
Historical Development: Invention wheel, early mechanics in design, mechanical advantages, industrial revolution, steam and petrol for mobility. Innovations in Electrical and Electronics: Electrical energy generation, electrical bulb, electrical equipment, electronics and automation, computing for early days to present, innovations in communications.
UNIT III
Systematic approach to product development: Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design
UNIT IV
Reverse engineering in product development: Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, 3D printing, study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, safety considerations in design.
UNIT V
Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling of groundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates, smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

Text Book

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4th edition, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2nd edition, Laurence King Publishing Ltd., 2010
3. An AVA Book, "Design Thinking", AVA Publishing, 2010.

Reference Books:

1. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3rd edition, Springer, 2007.
2. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 3rd edition, 2006.

CODE: CIV211 **MATHEMATICS III**

Lectures	: 3 Periods/week	Sessional Marks	: 30
Tutorials	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Objectives:

- To develop the tool of Fourier series and Fourier transforms for learning advanced Engineering mathematics.
- To enlighten the learners with the foundations of probability and statistical methods.
- To communicate probability concepts and statistical methods in various applications of engineering.
- To equip the students to solve application problems in their disciplines.

Course Outcomes:

Student will be able to

- Find Fourier series expansion for periodic functions
- Examine the properties of Fourier transformation.
- Classify Discrete and Continuous distributions of random variables
- Apply Central limit theorem for Sampling
- Use the concept of testing of hypothesis for large and small samples to draw the inferences.

UNIT I

Fourier Series:
Introduction and Euler's formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Even and Odd functions, Half range series, Typical wave forms and Parseval's formulae, Complex form of the Fourier series.

UNIT II

Fourier Integral Transforms:
Introduction- Definition – Fourier integrals – Fourier integral theorem (without proof)-Fourier sine and cosine integrals – complex form of Fourier integral – Fourier Transforms - Properties of Fourier Transforms - Finite Fourier sine and cosine transforms -Convolution theorem (without proof), Parsevals Identity for Fourier Transforms(without proof).

UNIT III

Probability and Distributions:
Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution function – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT IV

Sampling Theory:
Introduction – Population and samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Introduction to t, χ^2 and F-distributions – Point and Interval estimations – Maximum error of estimate.

UNIT V

Tests of Hypothesis:
Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.

TEXT BOOK:

1. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. Miller and Freunds, Probability and Statistics for Engineers, 7th edition, Pearson, 2008.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, New Age International.
2. N.P. Bali, A textbook of Engineering Mathematics, Laxmi publications, 9th edition, 2011
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons Publications, 2012.

WEB RESOURCES:

1. https://nptel.ac.in/courses/122/107/122107037/
2. https://nptel.ac.in/courses/122/103/122103012/

CODE: CIV212 **MECHANICS OF SOLIDS**

Lectures	: 3 Periods/week	Sessional Marks	: 30
Tutorials	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Learning Objectives:

• To impart preliminary concepts of Strength of Material and Principles of Elasticity and Plasticity Stress strain behavior of materials and their governing laws. Introduce student the moduli of Elasticity and their relations

• To impart concepts of Bending Moment and Shear force for beams with different boundary and loading conditions and to draw the diagrams of variation across the length.

• To give concepts of stresses developed in the cross section and bending equations calculation of section modulus of sections with different cross sections

• To classify cylinders based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure.

Course Outcomes:

• The student will be able to understand the basic materials behaviour under the influence of different external loading conditions and the support conditions

• The student will be able to draw the diagrams indicating the variation of the key performance features like bending moment and shear forces

• The student will have knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams and deflections due to various loading conditions

• The student will be able to assess stresses across section of the thin and thick cylinders to arrive at optimum sections to withstand the internal pressure using Lame's equation.

UNIT I

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

UNIT II

Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

UNIT III

Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

UNIT IV

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections. Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures

UNIT V

Thick Cylinders:

Thick Cylinders: Introduction Lame's theory for thick cylinders – Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells.

Text Books:

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA, 5th edition, 2002.

2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India, 2nd revised edition, 2017.

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

Reference Books:

1. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids, 2nd edition, New York, NY: McGraw Hill, 1979.
2. Laboratory Manual of Testing Materials - William Kendrick Hall.
3. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DE wolf– TMH, 2nd edition,2002.
4. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi, 3rd edition, 2016.

Web Resources:

1. https://nptel.ac.in/courses/112/107/112107146/
2. https://home.iitm.ac.in/kramesh/Strength%20of%20Materials%20Laboratory%20Manual.pdf

CODE: CIV213 **FLUID MECHANICS**

Lectures	: 3 Periods/week	Sessional Marks	: 30
Tutorials	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Learning Objectives:

• To understand the properties of fluids and fluid statics
• To derive the equation of conservation of mass and its application
• To solve kinematic problems such as finding particle paths and stream lines
• To use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems

Course Outcomes:

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

• Understand the various properties of fluids and their influence on fluid motion and analyse a variety of problems in fluid statics and dynamics.
• Calculate the forces that act on submerged planes and curves.
• Identify and analyse various types of fluid flows.
• Apply the integral forms of the three fundamental laws of fluid mechanics to turbulent and laminar flow through pipes and ducts in order to predict relevant pressures, velocities and forces.
• Draw simple hydraulic and energy gradient lines.

UNIT I

Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

UNIT II

Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT III

Fluid Kinematics- Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

UNIT IV

Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced;

UNIT V

Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber *Number and Euler Number; Buckingham's* π-Theorem.

Text Books:

1. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, 15th edition, 2004, Standard Book House
3. Fluid Mechanics, A.K. Jain, 4th edition, 2010, Khanna Publishers.

Reference Books

1. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill,
2. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill, 10th edition, 2001.

Web Resources:

1. https://nptel.ac.in/courses/112/104/112104118/
2. https://nptel.ac.in/courses/112/105/112105171/

CODE: CIV214 **SURVEYING & GEOMATICS**

Lectures : 4 Periods/week
University Exam : 3 hours

Sessional Marks : 30
University Exam marks: 70
Credits : 3

Course Learning Objectives:
To introduce the students to basic principles of surveying, various methods of linear and angles measuring instruments and enable the students to use surveying equipments.

Course Outcomes:
Upon successful completion of the course, the student will be able:
• To demonstrate the basic surveying skills
• To use various surveying instruments.
• To perform different methods of surveying
• To compute various data required for various methods of surveying.
• To integrate the knowledge and produce topographical maps.

UNIT I
Introduction: definition-Uses of surveying- overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications – Errors in survey measurements Distances And Direction: Electronic distance measurements (EDM)- principles of electro optical EDM-Errors and corrections to linear measurements- Compass survey, Meridians, Azimuths and Bearings, declination, computation of angle. Traversing-Purpose-types of traverse-traverse computation-traverse adjustments-Introduction omitted measurements
UNIT II
Leveling And Contouring: Concept and Terminology, Levelling Instruments and their Temporary and permanent adjustments- method of levelling. Characteristics and Uses of contours- methods of conducting contour surveys.
UNIT III
Theodolite: Description, principles-uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite – Introduction to Trigonometrical leveling,. Tachometric Surveying: Stadia and tangential methods of Tacheometry. Distance and Elevation formulae for Staff vertical position.
UNIT IV
Curves: Types of curves, design and setting out – simple and compound curves. Introduction to geodetic surveying, Total Station and Global positioning system
UNIT V
Photogrammetry Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

Text Books:
1 Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2 Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3 Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010

Reference Book:
1. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.
2. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
3. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.

Web Resources:
1. https://nptel.ac.in/courses/105/107/105107122/
2. https://www.evc.edu/AcademicAffairs/Documents/AS-Surveying-and-Geomatics.pdf

CIV215 **BUILDING MATERIALS & CONSTRUCTION**

Lectures : 4 Periods/week
University Exam : 3 hours

Sessional Marks : 30
University Exam marks: 70
Credits : 1.5

Objectives of the course:

• Initiating the student with the knowledge of basic building materials and their properties.
• Imparting the knowledge of course pattern in masonry construction and flat roofs and techniques of forming foundation, columns, beams, walls, sloped and flat roofs.
• The student is to be exposed to the various patterns of floors, walls, different types of paints and varnishes.
• Imparting the students with the techniques of formwork and scaffolding.
• The students should be exposed to classification of aggregates, moisture content of the aggregate.

Course outcome:

Upon the successful completion of the course:
• The student should be able to identify different building materials and their importance in building construction.
• The student is expected to differentiate brick masonry, stone masonry construction and use of lime and cement in various constructions.
• The student should have learnt the importance of building components and finishings.
• The student is expected to know the classification of aggregates, sieve analysis and moisture content usually required in building construction.

UNIT I

Stones: Qualities of a good building stone, Common building stones of India; **Bricks**: General; Composition of good brick earth; Harmful ingredients in brick earth; Manufacture of bricks by clamp burning and kiln (only Hoffmans kiln) burning, Qualities of good bricks; Tests for bricks; Classification of bricks; Size and weight of bricks.; **Lime**: General; Some definitions; Sources of lime; Constituents of limestones; Classification of limes; Properties of fat lime and hydraulic lime; **Timber**: Definition; Structure of a tree; Qualities of good timber; Decay of timber; Preservation of timber; Advantages of timber construction; Uses of timber.

UNIT II

Glass: Manufacture and Classification, Treatment of glass, uses of glass, testing for quality, Characteristics and Performance of glass, Glass fibre; **Plastics:** Classification of plastics, Properties of plastics, Fabrication of plastic articles, some plastics in common use, Reinforced plastics; **Paints:** Types of paints, Composition of paints, Considerations in choosing paints, Paints commonly used in buildings.

UNIT III

Plastering: Specifications for cement plastering, plastering method, Specifications for plastering with cement mortar; **Stone & Brick Masonry**: Technical terms; Types of bonds in brickwork and their suitability. Classification of stone masonry; **Walls**: Classification of walls.

UNIT IV

Floors: Technical terms; Types of ground floors; **Roofs**: Technical terms; Classification of roofs; Steel sloping roofs; Roof covering materials; Types of flat roofs; **Staircases**: Technical terms; Types of stair-cases, design considerations.

UNIT V

Dampness and Damp Proofing: Causes of dampness; Methods of preventing dampness; damp proofing materials and their classification; Methods of providing DPC under different situations **Acoustics of Buildings**: Important Technical terms; Factors to be considered in Acoustics of building; Sound absorbing materials; Sound insulation. **Scaffolding, Shoring, Under Pinning and Form Work**: Types of scaffolding; Types of shoring; Methods of underpinning; Types of formwork; Cantering.

TEXT BOOKS

1. Engineering Materials by S. C. Rangwala; Charotar Publishing House, Anand,
2. Building construction by B. C. Punmia et all; Laxmi Publications, New Delhi, 10th edition, 2012.
3. Planning and Designing Buildings by Yashwant S. Sane, Allies Book Stall, 2nd edition,

REFERENCE

Building Drawing by M.G. Shah, C.M. Kale and S.Y. Patki, Tata McGrqw-Hill, New Delhi.

WEB REFERENCES

1. https://nptel.ac.in/courses/105/102/105102088/
2. http://www.nptelvideos.in/2012/11/building-materials-and-construction.html

CODE: CIV251 **STRENGTH OF MATERIALS LAB**

Practicals : 3 Periods/week
University Exam : 3 hours

Sessional Marks : 30
University Exam marks: 70
Credits : 1.5

1. Study of stress-strain characteristics of mild steel bars by UTM.
2. Study of stress-strain characteristics of HYSD bars by UTM.
3. Determination of modulus of elasticity of the material of the beam by conducting bending test on simply supported beam.
4. Determination of modulus of elasticity of the material of the beam by conducting bending test on fixed beam.
5. Determination of modulus of elasticity of the material of the beam by conducting bending test on cantilever beam
6. Determination of modulus of rigidity by conducting torsion test on solid circular shaft.
7. Determination of hardness of the given material by Brinnel's hardness test
8. Determination of hardness of the given material by Rockwell hardness test.
9. Determination of hardness of the given material by Vickers hardness test.
10. Determination of impact strength of the given material by conducting Charpy
11. Determination of impact strength of the given material by conducting by Izod test
12. Determination of ultimate shear strength of steel by conducting direct shear test.
13. Determination of modulus of rigidity of the material of closely coiled helical spring.
14. Determination of modulus of rigidity of the material of open coiled helical spring.
15. Determination of compressive strength of wood with grain parallel to loading. Determination of compressive strength of wood with grain perpendicular to loading

CODE: CIV252 **SURVEYING FIELD WORK**

Practicals	: 3 Periods/week	Sessional Marks	:30
University Exam	: 3 hours	University Exam marks	:70
		Credits	:1.5

LIST OF EXPERIMENTS

CHAIN SURVEY:
1. Survey of an Area by chain survey (Closed Traverse).
Practical Application : To find the area of a given field.
2. Chaining across Obstacles.
Practical Application : To find the obstacles length

COMPASS SURVEY
1. Surveying of a given area by prismatic compass (Open Traverse).
Practical Application: To find the horizontal angles between the objects.
2. Surveying of a given area by prismatic compass (Closed Traverse).
Practical Application: To find the horizontal angles between the objects.

PLANE TABLE SURVEY:
1. Traversing by plane table survey.
Practical Application: To plot the given area.

THEODOLITE:
1. Measurement of horizontal angles by using Repetition Method.
Practical Application: To find the horizontal angles between the two points.
2. Measurement of horizontal angles by using Reiteration Method.
Practical Application: To find the horizontal angles between more than two points.
3. Measurement of Vertical angles.
Practical Application: To find the height of the object using vertical angles.

LEVELLING:
1. Differential Levelling:
Practical Application: To find the R.L's of the ground for laying the pipe line using any leveling Instrument.
2. Reciprocal Levelling:
Practical Application: Elevation difference between two points on both sides of river banks.

CODE: CIV253 **ENGINEERING GEOLOGY LAB**

Lectures	: 1 Period/week	Sessional Marks	:30
Tutorials	: 2 Periods/week	University Exam marks	:70
University Exam	: 3 hours	Credits	:1.5

Mineralogy And Petrology: Definitions of mineral, Structures of silicates and rock, Different methods of study of mineral and rock, The study of physical properties of minerals and rocks for megascopic study for the following minerals and rocks, Common rock forming minerals are Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and other ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite And Bauxite. Classification, structures, textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their megascopic study of granite varieties, (pink, gray, green). Pegmatite, Dolerite, Basalt etc., Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate and their importance in Civil Engineering.

LIST OF EXPERIMENTS

1. Study of physical properties of minerals.
2. Study of different group of minerals.
3. Study of Crystal and Crystal system.
4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite; Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
5. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.
6. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties , Laterite, Limestone and its varieties, Shales and its varieties.
7. Identification of rocks (Metamorphic Petrolody): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
8. Study of topographical features from Geological maps. Identification of symbols in maps.

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MANDATORY COURSE

CODE: MC150 **ENVIRONMENTAL STUDIES**

Lectures : 4 Periods/week
University Exam : 3 hours

Sessional Marks : 30
University Exam marks: 70
Credits : 0

Course Learning Objectives:

The objectives of the course is to impart

- Overall understanding of the natural resources
- Basic understanding of the ecosystem and its diversity
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities
- An understanding of the environmental impact of developmental activities
- Awareness on the social issues, environmental legislation and global treaties

Course Outcomes:

The student should have knowledge on

- The natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources
- The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web
- The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
- Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
- Social issues both rural and urban environment and the possible means to combat the challenges
- The environmental legislations of India and the first global initiatives towards sustainable development.
- About environmental assessment and the stages involved in EIA and the environmental audit.
- Self Sustaining Green Campus with Environment Friendly aspect of – Energy, Water and Wastewater reuse Plantation, Rain water Harvesting, Parking Curriculum.

UNIT I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT II

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION : Definition: genetic, species and ecosystem diversity – Bio- geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, Man - wild life conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of : Air Pollution. Water pollution, Soil pollution ,Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards

SOLID WASTE MANAGEMENT: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT IV

SOCIAL ISSUES AND THE ENVIRONMENT

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V

HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights– Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK: Visit to a local 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, and birds – river, hill slopes, etc.

TEXT BOOKS

1. Text book of Environmental Studies for Undergraduate Courses - Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies - Palaniswamy – Pearson education
3. Environmental Studies - Dr.S.Azeem Unnisa, Academic Publishing Company

REFERENCES

1. Textbook of Environmental Science - Deeksha Dave and E.Saibaba Reddy, Cengage Publications.
2. Text book of Environmental Science and Technology - M.Anji Reddy, BS Publication.
3. Comprehensive Environmental studies - J.P.Sharma, Laxmi publications.
4. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – PHI
5. A Text Book of Environmental Studies - G.R.Chatwal, Himalaya Publishing House
6. Introduction to Environmental engineering and science - Gilbert M. Masters and Wendell P. Ela- PHI.

WEB RESOURCES

1. https://nptel.ac.in/courses/122/102/122102006/
2. https://nptel.ac.in/courses/120/108/120108004/

CODE: CIV221 **CONCRETE TECHNOLOGY**

Lectures : 4 Periods/week
University Exam : 3 hours

Sessional Marks : 30
University Exam marks: 70
Credits : 3

Course Learning Objectives:
• To learn the concepts of Concrete production and its behaviour in various environments.
• To learn the test procedures for the determination of properties of concrete.
• To understand durability properties of concrete in various environments.

Course Outcomes:
Upon successful completion of this course, student will be able to
• understand the basic concepts of concrete.
• realize the importance of quality of concrete.
• familiarize the basic ingredients of concrete and their role in the production of concrete and its behaviour in the field.
• test the fresh concrete properties and the hardened concrete properties.
• evaluate the ingredients of concrete through lab test results. design the concrete mix by BIS method.
• familiarize the basic concepts of special concrete and their production and applications. understand the behaviour of concrete in various environments.

UNIT I

Cement
General, Manufacture of Portland cement by dry process, Approximate oxide composition limits of OPC, Bogue's compounds, Hydration of cement, heat of hydration, structure of hydrated cement.

Types Of Cements and testing of cement
Ordinary Portland cement, low alkali cement, Rapid hardening cement, Sulphate resisting cement, Portland blast furnace slag cement, Portland pozzolana cement, air entraining cement, white cement, hydro phobic cement, oil well cement, low heat Portland cement.
Soundness test, Setting times test, Compressive strength test and Fineness test by air permeability apparatus.

Aggregates And Testing Of Aggregates
Classification of aggregates according to size and shape. Characteristics of aggregates-shape and texture, cleanliness, toughness, hardness.
Tests for bulking of fine aggregate, Fineness modulus and Zoning of fine aggregate, Fineness modulus of coarse aggregate.

UNIT II

Water
Tolerable concentrations of impurities in mixing water, Use of sea water for mixing concrete.

Fresh Concrete
Workability, factors affecting workability, Segregation and Bleeding in concrete, measurement of workability using slump cone test, Kelly ball test, Vee-Bee test, compaction factor test.

Hardened Concrete
Factors affecting compressive strength of concrete, Cube compression test, split tensile strength test, flexural strength of concrete.

UNIT III

Durability of concrete
Factors affecting durability of concrete. Time dependent behavior of concrete- Shrinkage, creep, fatigue. Types & factors effecting of creep and shrinkage. Resistance to freezing sulphate and acid attacks.

Production of Concrete
Batching of materials, mixing, transportation, placing, compaction and finishing of concrete. Curing of concrete and methods of curing.

Concrete Mix Design
Basic considerations for concrete mix design, factors influencing the choice of mix proportions, Indian standard method of concrete mix design

UNIT IV

Ready Mixed Concrete (RMC)
Advantages of RMC, components of RMC plant, distribution and transportation, handling and placing, specifications for ready mix concrete as per IS:4926-2003.

Inspection and testing of concrete – concrete cracking, types of cracks, causes and remedies. Non-destructive tests on concrete – rebound hammer, ultra pulse velocity tests.

Chemical And Mineral Admixtures

Functions of admixtures, accelerators, retarders, air entraining admixtures, plasticizers and super plasticizers, water proofers, fly ash, silica fume, ground granulated blast furnace slag. Uses of ad mixtures

UNIT V

Special Materials in Construction and Concreting Techniques

Ferro-cement, self-compacting concrete, fiber reinforced concrete, high strength concrete. Shortcrete or guniting. Polymer concrete, high performance concrete, light weight concrete.

Future Trends In Concrete Technology

Recycled aggregate concrete, properties of recycled aggregate concrete, green building, maintenance, need for green buildings.

TEXT BOOKS

1. Concrete technology by A.R.Santha kumar, 2nd Edition, Oxford University Press – 2018.
2. Concrete technology by M.S.Shetty, 8th Edition, S.Chand & Company Pvt. Ltd., New Delhi – 2018.

REFERENCE BOOKS

1. Properties of concrete by A.M.Neville, 5th Edition, Longman Publishers.
2. Concrete technology by M.L.Gambhir, 3rd Edition, Tata McGraw-Hill Publishing company Ltd., New Delhi

WEB RESOURCES

1. https://nptel.ac.in/courses/105/102/105102012/
2. https://nptel.ac.in/courses/105/106/105106176/

CODE: CIV222 **MECHANICS OF MATERIALS**

Lectures	: 4 Periods/week	Sessional Marks	: 30
Tutorials	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Learning Objectives:

• To give concepts of Principal stresses and strains developed in cross section of the beams on the cross section and stresses on any inclined plane. To impart concepts of failures in the material considering different theories

• To give concepts of torsion and governing torsion equation, and there by calculate the power transmitted by shafts and springs and design the cross section when subjected to loading using different theories of failures.

• To classify columns and calculation of load carrying capacity and to assess stresses due to axial and lateral loads for different edge conditions and to calculate combined effect of direct and bending stresses on different engineering structures.

• Introduce the concept of unsymmetrical bending in beams Location of neutral axis Deflection of beams under unsymmetrical bending.

• Impart concepts for determination of Forces in members of plane pin-jointed perfect trusses by different Methods

Course Outcomes:

Upon successful completion of this course,

• The student will be able to understand the basic concepts of Principal stresses developed in a member when it is subjected to stresses along different axes and design the sections.

• The student can asses stresses in different engineering applications like shafts, springs, columns and struts subjected to different loading conditions

• The student will be able to assess forces in different types of trusses used in construction.

UNIT I

Principal Stresses And Strains And Theories Of Failures: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories Of Failures: Introduction – Various Theories of failures like Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

UNIT II

Torsion Of Circular Shafts And Springs: Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\phi/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel – Carriage or leaf springs.

UNIT III

Columns: Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

UNIT IV

Direct And Bending Stresses: Stresses under the combined action of direct loading and B.M. Core of a section – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and B.M. about both axis.

UNIT V

Unsymetrical Bending: Introduction – Centroidal principal axes of section – Graphical method for locating principal axes – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis Deflection of beams under unsymmetrical bending. Shear Centre.

TEXT BOOKS:

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", 5th Edition, DVNC, New York, USA.
2. Kazmi, S. M. A., "Solid Mechanics" 1st Edition, TMH, Delhi, India.
3. Hibbeler, R. C. Mechanics of Materials. 6th Edition. East Rutherford, NJ: Pearson Prentice Hall, 2004.

REFERENCE BOOKS:

1. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd Edition, New York, NY: McGraw Hill, 1979
2. Laboratory Manual of Testing Materials - William Kendrick Hall, 1913.
3. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. Dewolf– TMH 2002.
4. Strength of Materials by R. Subramanian, 3rd Edition, Oxford University Press, New Delhi.

WEB REFERENCES:

1. https://nptel.ac.in/courses/105/106/105106172/
2. https://nptel.ac.in/courses/105/105/105105108/

CODE: CIV223 **STRUCTURAL ANALYSIS**

Lectures	: 4 Periods/week	Sessional Marks	: 30
Tutorials	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Learning Objectives:

• To give preliminary concepts of assessment of bending moment and shear force in Propped cantilevers, fixed beams and continuous beams due to various loading conditions.
• To impart concepts of Bending Moment and Shear force for beams with different boundary and loading conditions
• The concepts of moving loads and influence lines are imparted for assessment of maximum SF and BM at a given section.

Course Outcomes:

Upon successful completion of this course the student will be able to,
• Distinguish between the determinate and indeterminate structures.
• Identify the behaviour of structures due to the expected loads, including the moving loads, acting on the structure.
• Estimate the bending moment and shear forces in beams for different fixity conditions.
• Analyze the continuous beams using various methods -, three moment method, energy theorems.
• Draw the influence line diagrams for various types of moving loads on beams/bridges.

UNIT I

Displacements Of Determinate Structures Using Energy Methods

Maxwell's reciprocal theorem; Maxwell – Betti's generalized reciprocal theorem; castigliano's theorems; Application of Castigliano's theorem for calculating deflection of beams, frames and trusses; Virtual work method for deflections.

UNIT II

Influence Lines For Statically Determinate Structures

Moving loads and influence lines; Influence lines for beam reactions; Influence lines for shearing force; Influence lines for bending moment; Calculation of maximum shear force and bending moment at a section for rolling loads; Calculation of absolute maximum bending moment; Influence lines for simple trusses.

UNIT III

Propped Cantilevers

Analysis of propped cantilevers-shear force and Bending moment diagrams-Deflection of propped cantilevers.

UNIT IV

Fixed Beams

Introduction to statically indeterminate beams with U. D. load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - shear force and Bending moment diagrams-Deflection of fixed beams including effect of sinking of support, effect of rotation of a support.

UNIT V

Clapeyron's Theorem Of Three Moments

Introduction-Clapeyron's theorem of three moments. Analysis of continuous beams with constant moment of inertia with one or both ends fixedcontinuous beams with overhang, continuous beams with different moment of inertia for different spans-Effects of sinking of supports-shear force and Bending moment diagrams.

TEXT BOOK:

1. Analysis of Structures vols. 1 & 2 by Vazirani & Ratwani; 17th Edition, Khanna Publishers; Delhi.
2. Structural Analysis by Devdas Menon, 2nd Edition, Narosa Publishinh House.

REFERENCE BOOKS:

1. Indeterminate structural analysis by C. K. Wang, McGraw-Hill Publications – 1983.
2. Mechanics of structures – II by Junnarkar & Shah, 32 Edition, Charotar Publishing House – 2017.
3. Structural analysis by R. C. Hibbeler, 10th Edition, Pearson Education.
4. Basic Structural Analysis by C. S. Reddy, 3rd Edition, Tata McGraw-Hill – 2011.

WEB REFERENCES:

1. https://nptel.ac.in/courses/105/105/105105166/
2. https://nptel.ac.in/courses/105/101/105101085/

CIV224 **HYDRAULICS AND HYDRAULIC MACHINES**

Lectures	: 4 Periods/week	Sessional Marks	: 30
Tutorials	: 1 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 3

Course Learning Objectives:
• To study about uniform and non uniform flows in open channel and also to learn about the characteristics of hydraulic jump
• To introduce dimensional analysis for fluid flow problems
• To understand the working principles of various types of hydraulic machines and Pumps.

Course Outcomes:
Upon successful completion of this course the students will be able to:
• Solve uniform and non uniform open channel flow problems.
• Apply the principals of dimensional analysis and similitude in hydraulic model testing.
• Understand the working principles of various hydraulic machineries and pumps.

UNIT I
Laminar Flow- Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.
UNIT II
Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram
UNIT III
Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Non-Uniform Flow- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions.
UNIT IV
Hydraulic Jump- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types,applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges. Dynamics of Fluid Flow, Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation,
UNIT V
Flow through Pipes: Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.

TEXT BOOKS:
1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, 21st Edition, Standard Book House – 2018.
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill – 1993.

REFERENCE BOOKS:
3. Open Channel Flow, K. Subramanya, 3rd Edition, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill – 2009.

WEB REFERENCES:
1. https://nptel.ac.in/courses/105/103/105103096/
2. https://nptel.ac.in/courses/105/103/105103021/

CODE: CIV225 **PROFESSIONAL ETHICS AND HUMAN VALUES**

Lectures	: 3 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	:1.5

Course Objectives:

- To give basic insights and inputs to the student to inculcate Human values to grow as a responsible human beings with proper personality.
- Professional Ethics instills the student to maintain ethical conduct and discharge
- their professional duties.

Course Outcome:

- It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.
- It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
3. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.

REFERENCE BOOKS:

1. A N Tripathy, 2003, Human Values, New Age International Publishers.
2. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
3. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
4. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
5. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
6. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
7. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

WEB REFERENCES:

1. https://nptel.ac.in/courses/110/105/110105097/
2. https://nptel.ac.in/courses/109/104/109104068/

MANDATORY COURSE

CODE: CE326 **CONSTITUTION OF INDIA**

Lectures : 3 Periods/week
University Exam : 3 hours

Sessional Marks : 30
University Exam marks: 70
Credits :1.5

UNIT I
Introduction to Indian Constitution: Meaning of the term Constitution. *Making of Indian Constitution:* Constitutional history, Drafting Committee and Sources, *Philosophy of Indian Constitution:* Preamble and Features. Citizenship, Fundamental Rights and Duties, Directive Principles of State Policy.
UNIT II
Union Government and its Administration Structure : Organs of the Government : Legislative, Executive and Judiciary. The term Federalism and Centre-State relationship. *President*: Role, power and position. Prime Minister and Council of ministers, Cabinet, Central Secretariat, Lok Sabha, Rajya Sabha. *The Supreme Court and High Court:* Powers and Functions.
UNIT III
State Government and its Administration: *Governor*: Role and Position. Chief Minister and Council of ministers. *State Secretariat*: Organization, Structure and Functions.
UNIT IV
Local Administration: *District's Administration:* Head and his/her Role and Importance. *Urban administration*: Municipalities - Mayor and role of Elected Representative, CEO of Municipal Corporation. *Rural administration* : Pachayati Raj and its Functions. *PRI*: Zilla Panchayat, Elected officials and their roles, CEO of Zilla Panchayat. Block level Organizational Hierarchy (Different departments), *Village level administration* : Role of Elected and Appointed officials. Importance of grass root democracy.
UNIT V
Election Commission: Role of Chief Election Commissioner and Election Commissionerate, State Election Commission, Functions of Commissions for the welfare of SC/ST/OBC and women.

TEXT BOOKS:

1. Introduction to the Constitution of India, Durga Das Basu PHI, New Delhi
2. Indian Constitution, Subash Kashyap, National Book Trust
3. Dynamics of Indian Government & Politics,J.A.Siwach

REFERENCE BOOKS

1. Constitutional Law of India, 4th edition in 3 volumes, H.M.Sreevai, Universal Law Publication
2. Indian Government and Politics, J.C. Johari
3. Indian Government and Politics, J. Raj
4. Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, M.V. Pylee, PHI, New Delhi
5. Challenges to Civil Rights Guarantees in India, A.G.Noorani, A.G.,Oxford University Press 2012
6. Indian Government and Politics,D.C. Gupta

WEB REFERENCE

1. https://nptel.ac.in/courses/129/106/129106002/
2. https://nptel.ac.in/courses/129/106/129106003/

CODE: CIV261 **BUILDING PLANNING AND DRAWING LAB**

Lectures	: 1 Periods/week	Sessional Marks	: 30
Practicals	: 2 Period/week	University Exam marks	: 70
University Exam	: 3 hours	Credits	: 1.5

An Approach to Planning

Site planning; Space requirement–Establishing areas for different units, Furniture requirements, Roominess, Flexibility, Sanitation, Lighting, Ventilation, Space for equipment for air– conditioning, Space for machinery etc.; Flow diagram and line plan–Grouping, Circulation, Orientation, Aspect and prospect, Privacy, Elegance and economy; Climatic considerations; Architectural composition–Unity, Mass composition, Contrast, Proportion, Scale, Accentuation and rhythm, Materials for the exterior and Expression; Colour.

Building Rules and Bye–Laws

Zoning regulations; Regulations regarding layouts or sub-divisions; Building regulations; Rules for special type of buildings; Calculation of plinth, floor and carpet area; Floor space index.

Building Elements

Conventional signs; Guidelines for staircase planning; Guidelines for selecting doors and windows; Terms used in the construction of door and window; Specifications for the drawing of door and window

List of Drawing Experiments:

1. Learning basic commands of CAD software & drawing various geometrical shapes
2. Draw Conventional signs for building materials and symbols for sanitary installations and fittings
3. Draw symbols for Doors & Windows and Electrical Installations
4. Draw Elevation and Sections of Door & Window
5. Draw Cross section of load bearing wall over spread footing
6. Draw plan & sectional elevation of Dog-Legged staircase
7. Draw Pitched roof (King post truss)
8. Draw plan of a single storied residential building showing furniture & cub-boards using layers and blocks in CAD software
9. Draw plan of a single storied residential building showing Electrical and Sanitary features using layers and blocks in CAD software
10. Draw Plan, Section & Elevation of single storied residential building
11. Learning basic commands in 3-D, creating pre-defined solid primitives and applying Boolean operations
12. Create a two roomed ground floor building in 3-D and render the model

CODE: CIV262 **CONCRETE TESTING LAB**

Practicals : 3 Periods/week
University Exam : 3 hours

Sessional Marks : 30
University Exam marks: 70
Credits : 1.5

List of Experiments

1. Determination of Normal consistency and Fineness of cement
2. Determination of Initial setting and final setting time of cement
3. Determination of Specific gravity of cement
4. Determination of Fineness modulus of Fine aggregate
5. Determination of Fineness modulus of Coarse aggregate
6. Determination of workability of concrete by conducting Slump cone Test
7. Determination of workability of concrete by conducting Compaction factor test
8. Determination of workability of concrete by conducting Vee- bee consistometer Test
9. Determination of Cube compression strength of concrete
10. Determination of Split tensile strength of Concrete.
11. Determination of Modulus of Elasticity of Concrete by conducting compression test on Concrete Cylinder
12. Specific gravity of Fine aggregate and Coarse aggregate
13. Schmidt Rebound Hammer Test
14. Pulse velocity test
15. Determination of Soundness test of Cement
16. Permeability test

CODE: CIV263 **HYDRAULICS AND HYDRAULIC MACHINES LAB**

Practicals	: 3 Periods/week	Sessional Marks	: 30
University Exam	: 3 hours	University Exam marks	: 70
		Credits	:1.5

List of Experiments

1. Verification of Bernoulli's theorem.
2. Venturimeter: Determination of Coefficient of discharge.
3. Orificemeter: Determination of Coefficient of discharge.
4. Orifice : Determination of Coefficient of discharge by steady and unsteady flow methods.
5. Mouthpieces: Determination of Coefficient of discharge by steady and unsteady flow methods.
6. Characterization of laminar and turbulent flows by Reynold's apparatus.
7. Determination of friction factor of Pipes.
8. Determination of loss of head in pipes due to bend /sudden contraction/ sudden expansion.
9. Determination of Coefficient of discharge for rectangular notch / V – notch.
10. Determination of Manning's and Chezy's coefficients in open channel.
11. Study on Characteristics of Hydraulic Jump
12. Measurement of force due to impact of jets on vanes of different types.
13. Performance studies on Pelton turbine.
14. Performance studies on Francis turbine /Kaplan turbine.
15. Performance studies on single stage centrifugal pump.
16. Performance studies on Reciprocating pump.