Scheme of Study and Syllabus
for
First Year B. Tech. / M. Tech. (5 – Year Integrated) Degree Programmes
for
Students admitted from 2020-21
# I Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>No of Contact Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG101R01/BIT101R01</td>
<td>Technical Communication/Biology for Engineers</td>
<td>1 0 2</td>
<td>2</td>
</tr>
<tr>
<td>MAT101R01</td>
<td>Engineering Mathematics – I</td>
<td>3 1 0</td>
<td>4</td>
</tr>
<tr>
<td>CSE101</td>
<td>Problem Solving &amp; Programming in C</td>
<td>3 0 2</td>
<td>4</td>
</tr>
<tr>
<td>PHY101R01/CHY101</td>
<td>Engineering Physics/Engineering Chemistry</td>
<td>3 0 2</td>
<td>4</td>
</tr>
<tr>
<td>EEE101/EIE101R01</td>
<td>Basic Electrical Engineering/Basic Electronics Engineering</td>
<td>2 0 2</td>
<td>3</td>
</tr>
<tr>
<td>CIV101/MEC101</td>
<td>Basic Civil Engineering/Basic Mechanical Engineering</td>
<td>2 0 2</td>
<td>3</td>
</tr>
<tr>
<td>CIV102/CIV103</td>
<td>Engineering Mechanics/Engineering Graphics</td>
<td>2 1 0</td>
<td>3</td>
</tr>
<tr>
<td>MEC102</td>
<td>Introduction to Engineering Design</td>
<td>2 0 0</td>
<td>2</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Group I</td>
<td>(Technical Communication, Physics, Electrical, Civil, Mechanics &amp; Design)</td>
<td>18 2 10</td>
<td>25</td>
</tr>
<tr>
<td>Group II</td>
<td>(Biology, Chemistry, Electronics, Mechanical &amp; Graphics)</td>
<td>15 1 14</td>
<td>23</td>
</tr>
</tbody>
</table>

# II Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>No of Contact Hours / Week</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ENG101R01/BIT101R01</td>
<td>Technical Communication/Biology for Engineers</td>
<td>1 0 2</td>
<td>2</td>
</tr>
<tr>
<td>MAT102R01</td>
<td>Engineering Mathematics – II</td>
<td>3 1 0</td>
<td>4</td>
</tr>
<tr>
<td>CSE201</td>
<td>Object Oriented Programming in C++</td>
<td>3 0 2</td>
<td>4</td>
</tr>
<tr>
<td>PHY101R01/CHY101</td>
<td>Engineering Physics/Engineering Chemistry</td>
<td>3 0 2</td>
<td>4</td>
</tr>
<tr>
<td>EEE101/EIE101R01</td>
<td>Basic Electrical Engineering/Basic Electronics Engineering</td>
<td>2 0 2</td>
<td>3</td>
</tr>
<tr>
<td>CIV101/MEC101</td>
<td>Basic Civil Engineering/Basic Mechanical Engineering</td>
<td>2 0 2</td>
<td>3</td>
</tr>
<tr>
<td>CIV102/CIV103</td>
<td>Engineering Mechanics/Engineering Graphics</td>
<td>2 1 0</td>
<td>3</td>
</tr>
<tr>
<td>MEC102</td>
<td>Introduction to Engineering Design</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
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<td>(Technical Communication, Physics, Electrical, Civil, Mechanics &amp; Design)</td>
<td>18 2 10</td>
<td>25</td>
</tr>
</tbody>
</table>
COURSE NAME: TECHNICAL COMMUNICATION

Course Objectives
The course enables the Engineering students to communicate effectively in their courses and in their careers. Centred on both technical and business communication, the course endeavours to train the learners in written and oral communication.

Unit I: Technical Communication Basics  8 Periods
Technical Communication: Nature and Scope; Characteristics of a Technical Document; Planning, Drafting, Revising, Understanding audience and purpose; Researching the subject; Understanding the research process; Choosing appropriate research methods; Secondary and Primary research; Continuous collaboration between technical communicators and stakeholders. Principles for Organizing Technical Information; Conventional Organizational Patterns: Chronological, Spatial, General to Specific, More Important to Less Important, Comparison and Contrast, Classification or Partition, Problem-Methods-Solution, Cause and Effect.

Unit II: Writing Technical Documents  12 Periods
Writing Reports: Understanding the Process of Writing Informational Reports; Writing Directives, Field Reports, Progress and Status Reports, Incident Reports Meeting Minutes; Writing Recommendation Reports; Writing Lab Reports; Writing Proposals: Understanding the Process; The Logistics of Proposals; Internal and External Proposals; Solicited and Unsolicited Proposals, Research Proposals; The “Deliverables” and Structure; Writing Definitions: Parenthetical Definitions, Sentence Definitions, Extended Definitions; Guidelines for Writing Effective Definitions. Writing Descriptions: The Nature and Scope of the Description; Introducing the Description; Providing Appropriate Detail; Writing Instructions: Understanding the role of instructional videos, Designing a set of written instructions; General Instructions, Step-By-Step Instructions. Writing User Manuals; Scientific Papers.

Unit III: Business Communication  10 Periods
Understanding the Process of Writing Business Correspondence; Selecting a Type of Correspondence; Using the appropriate level of formality; Communicating correctly; Projecting the “you attitude.” Avoiding correspondence clichés; Writing honest business correspondence. Elements of a Letter; Common Types of Letters: Inquiry Letter Response to an Inquiry, Claim Letter, Adjustment Letter, Calling for quotation, Placing order. Writing Memos, Emails, Microblogs, Writing Correspondence to Multicultural Readers; Employment correspondence: Understanding the Job-Application Process, Establishing Your Professional Brand; Planning the Job Search, Writing Résumés and Job-Application Letters, Preparing for a Job Interview; Writing Follow-up Letters after Interview.

Unit IV: Making Oral Presentations  7 Periods
Understanding the Role of Oral Presentations; the Process of Preparing and Delivering Presentation. Analyzing the Speaking Situation; Analyzing the Audience and Purpose; Organizing and Developing the Presentation. Planning the Introduction and the Conclusion; Preparing Presentation Graphics; Using Language to Signal Advance Organizers, Summaries, and Transitions; Rehearsing and Delivering the Presentation. Using Voice and Body Effectively; Answering Questions after Presentation.
Unit V: Language Aspects in Technical Communication 8 Periods
Skimming Sources and Taking Notes: Paraphrasing, quoting and summarizing; Documenting Your Sources: APA, IEEE and MLA Style; Editing and Proofreading Documents: Punctuation, Mechanics, Proofreading symbols; Cultural and Stylistic Communication Issues. Sentence-Level Issues: Articles and Nouns, Prepositions and Sentence Structure; Writing Grammatically Correct and Effective Sentences; Choosing the Right Words and Phrases; Using technical jargon appropriately; Avoiding: Sentence Fragments, Comma Splices, Run-On Sentences, Ambiguous Pronoun References; Using Adjectives Clearly, Maintaining Subject-Verb Agreement, Pronoun-Antecedent Agreement, Using Tenses Correctly.

REFERENCES

ONLINE RESOURCES
2. Purdue Online Writing Lab: https://owl.english.purdue.edu/owl/section/1/

LEARNING OUTCOMES
At the end of the course, the learner will be able to:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit I</td>
<td>Recognize the nature and scope of technical communication. Apply conventional patterns of organizing of technical texts.</td>
</tr>
<tr>
<td>Unit II</td>
<td>Draft various kinds of technical documents like: reports, proposals, user manuals and so on. Produce technical definitions, descriptions and instructions.</td>
</tr>
<tr>
<td>Unit III</td>
<td>Prepare all types of business correspondence with appropriate level of formality. Write planned job-related correspondence.</td>
</tr>
<tr>
<td>Unit IV</td>
<td>Demonstrate skill of oral presentation on technical and general contexts.</td>
</tr>
<tr>
<td>Unit V</td>
<td>Recognize the grammatical structures. Follow style manuals while documenting sources.</td>
</tr>
</tbody>
</table>
Course Code: BIT101R01
Semester: I / II

BIOLOGY FOR ENGINEERS

COURSE OBJECTIVES

The objective of this course is to enable learners to understand the basic organization, functions and characteristics of living organisms, and apply them for various Engineering applications.

Module 1 Introduction to Bio-inspired Engineering (1 h)
Introduce the course with examples of bioinspiration, biomimicry and biomimetics

Module 2 Cell & its constituents for the Development of Bio-sensors (11 h)
Biomolecules - the building blocks of Cell: Carbohydrates-classification, types and functions; Nucleic Acids - types and functions (DNA and RNA); Lipids – classification and functions; Proteins – types, structure and functions; Enzymes – Activation energy, co-enzymes; Biosensor (Applications in Healthcare, Food and Environmental Science)
Cell structure and function; Microorganisms, Biofilters (Pollution control and treatment), Self-healing concrete

Module 3 Flow of Genetic Information - Storage, Optimization and Retrieval (4 h)
The central dogma in molecular biology - Transcription and Translation, DNA as data storage system; Darwinian evolution, Genetic Algorithms

Module 4 Interdisciplinary technologies inspired from organ systems-I (6 h)
Immune System, artificial immune system and swarm robotics; Cardiovascular, Respiratory, Renal system, Stem Cells & 3D bio-printing, Human Organ-on-chip

Module 5 Interdisciplinary technologies inspired from organ systems-II (7 h)
Muscular System, Ionic and Electroactive polymers, Bio-robotics; Sensory organs (eye, ear, smell, taste, touch); Bio-optics & Bionics; Nervous System, Artificial neural networks

Module 6 Laboratory Experiments (2 h)
Exp. 1: Introduction to biosafety laboratory practices and bio-waste disposal
Exp. 2: Comparison of self-cleaning property on natural and synthetic surfaces
Exp. 3: Demonstration of 3D Printing
Textbooks:


References:


Learning Outcomes

| Module 1 | Outline the current technological inventions inspired from biology |
| Module 2 | Explain the basic units of life and apply the concepts for engineering applications |
| Module 3 | Describe the flow of information in cell and evolution and apply them for data optimisation and storage |
| Modules 4 & 5 | Illustrate the interdisciplinary technologies inspired from human organ systems |
| Module 6 | Apply theoretical knowledge of basic biology in engineering applications |
Course code: MAT101R01
Semester: I

ENGINEERING MATHEMATICS – I
(COMMON FOR ALL BRANCHES OF ENGINEERING)

Course Objectives
The course aims to train the learner to:

- Understand the various techniques of expansion of trigonometric functions, hyperbolic and logarithmic functions.
- Know methods of finding Eigen values and Eigen vectors for a given matrix and understand the transformation of quadratic forms to canonical forms through orthogonal transformations.
- Know the various techniques to find the summation of infinite series and in the transformation of algebraic equations that will serve them well towards tackling more topics at advanced levels of mathematics.
- Understand the concepts of Improper integrals and their applications.

UNIT I: Trigonometry

Expansions of \( \sin n\theta \) and \( \cos n\theta \) in powers of \( \sin\theta \) and \( \cos\theta \) – Expansions of \( \sin^n \theta \) and \( \cos^n \theta \) in terms of sines and cosines of multiples of \( \theta \) – Expansions of \( \sin \theta \) and \( \cos \theta \) as powers of \( \theta \) – Related problems - Hyperbolic and Inverse hyperbolic functions – Logarithm of complex numbers – separation of complex functions into real and imaginary parts.

Problems related to hyperbolic and circular functions

UNIT – II: Matrix Algebra:


Applications related to system of equations and Eigen values

UNIT – III : Theory of Equations & Algebra


Stability analysis based on zeros of a polynomial equation.

Algebra: Binomial, Exponential and Logarithmic Series (without proof) – Problems on summation, coefficient and approximations and its applications in probability distributions.
UNIT – IV: Improper and Multiple Integrals 15 Periods

**Improper Integrals:** Concept of improper integrals with examples – Definition of Beta and Gamma integrals – Relation between them – Properties of Beta and Gamma integrals – Evaluation of definite integrals in terms of Beta and Gamma integrals – Simple applications (evaluation of double and triple integrals).

**Multiple Integrals:** Double Integrals – Evaluations – Change of order of integration – Triple integrals (problems involving Jacobians are not included).

Density, Volume, Mass, Moments of Inertia

**TEXT BOOKS**

**REFERENCES**

**Online materials:**
1. NPTEL: https://nptel.ac.in/courses/122/104/122104017/
2. NPTEL: https://nptel.ac.in/courses/111/105/111105035/
3. NPTEL: https://nptel.ac.in/courses/111/107/111107018/
4. NPTEL: https://nptel.ac.in/courses/122/104/122104018/

**UNIT-WISE LEARNING OUTCOMES**
Upon completion of each unit, the learner will be able to:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit I</td>
<td>Demonstrate an understanding of circular and hyperbolic functions and their applications.</td>
</tr>
<tr>
<td>Unit II</td>
<td>Calculate rank of matrix, compute the Eigen values and Eigen vectors for diagonalisation of matrices</td>
</tr>
<tr>
<td>Unit III</td>
<td>Develop skills to locate the position of roots and determine their characteristics.</td>
</tr>
<tr>
<td>Unit IV</td>
<td>Apply the concept of change of order of integration, evaluation of multiple integrals and their usage in computing the areas and volumes.</td>
</tr>
</tbody>
</table>
COURSE LEARNING OUTCOMES
After the successful completion of the course, the student will be able to:

<table>
<thead>
<tr>
<th>CO No.</th>
<th>Course Outcome</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1.</td>
<td>Acquire the knowledge of circular and hyperbolic functions of a complex variable.</td>
<td>K3</td>
</tr>
<tr>
<td>CO2.</td>
<td>Apply the theoretical knowledge for finding the roots of a given equation in practical problems.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3.</td>
<td>Applying a polynomial method to perform stability analysis in control systems</td>
<td>K3</td>
</tr>
<tr>
<td>CO4.</td>
<td>Apply the matrix techniques to reduce the quadratic forms to canonical forms, find solutions of systems of linear equations in different areas of Linear Algebra.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5.</td>
<td>Evaluate some special functions like Gamma &amp; Beta functions and learn the relation between them to definite integrals arising in various branches of Engineering.</td>
<td>K3</td>
</tr>
<tr>
<td>CO6.</td>
<td>Evaluate the mass, moment of inertia and density of solid objects.</td>
<td>K3</td>
</tr>
</tbody>
</table>
B. Tech. / M. Tech. (Integrated) First year

Course Code: CSE101
Semester: I

PROBLEM SOLVING & PROGRAMMING IN C

Course Objective:
This course will help the learner to formulate simple algorithms for arithmetic & logical problems and translate the algorithms to C programs using constructs like arrays, functions, pointers & structures.

UNIT – I  11 Periods
Introduction
Flowchart and algorithms, swapping of two numbers, simple arithmetic problems, even or odd number, greatest of three numbers, finding roots of a quadratic equation, factorial, sum of n numbers, reversing the digits of a number, gcd, base conversion, generation of fibonacci series

Introduction to C
Character set, identifiers and keywords, data types, constants, variables and arrays, declarations, expressions, statements, symbolic constant

Operators and Expressions
Arithmetic operators, unary operators, relational and logical operators, assignment operators

UNIT – II  11 Periods
Library Functions and Data I/O
getchar, putchar, scanf, printf, gets, puts, interactive programming

Control Statements
if else statement, conditional operator, while, do-while and for statements, nested control structures, switch statement, break and continue statements, comma operator

Functions
Defining and accessing a function, function prototypes, passing arguments to a function, recursion

Applications
Operations on a set of numbers, finding factorial, sum of series, operations on digits of an integer, base conversion, character to number conversion

UNIT – III  11 Periods
Storage Classes
Automatic, External and static variables, multi file programs

Arrays
Definition, processing, passing arrays to functions, multi dimensional arrays
Strings
Definition, NULL character, initialization of strings, reading and writing a string, processing the strings, character arithmetic

Applications
Insertion and deletion in an array, bubble sort, linear and binary search, removal of duplicates from an ordered array, partitioning an array, prime factorization, keyword searching in a text, searching & sorting of strings

UNIT – IV 12 Periods
Pointers
Fundamentals, pointer declarations, passing pointers to a function, pointers and one dimensional arrays, dynamic memory allocation, operations on pointers, pointers and multi dimensional arrays, arrays of pointers, more about pointer declarations

Structures and Unions
Defining and processing a structure, user defined data types (typedef), structures and pointers, passing structures to functions, self referential structures, unions

Applications
Programs using array of structures and array operations using pointer arithmetic

TEXTBOOKS

REFERENCES

ONLINE MATERIALS
1. NPTEL –http://nptel.ac.in/courses/106104128/
2. NPTEL –http://nptel.ac.in/courses/106102066/

LEARNING OUTCOMES
Upon successful completion of each unit, the learner will be able to

<table>
<thead>
<tr>
<th>Unit I</th>
<th>• Write simple algorithms for arithmetic and logical problems</th>
</tr>
</thead>
</table>
| Unit II | • Develop programs using input and output statements  
| | • Recall the syntax of branching and looping constructs  
| | • Select an appropriate construct to solve the given problem  
| | • Develop programs using functions |
| Unit III | • Illustrate the operations on arrays  
| | • Demonstrate string operations |
| Unit IV | • Employ structures and pointers for developing a given application |
LIST OF LAB EXERCISES

1. Programs using Input, output and assignment statements
2. Programs using Branching statements
3. Programs using Looping statements
4. Programs using Functions
5. Programs using Recursion
6. Programs using Single and Multidimensional Arrays
7. Programs using strings
8. Programs using Pointers
9. Programs using dynamic memory allocation
10. Programs using Structures
Course Objectives:
The objectives of the course are:

- To provide fundamental knowledge about quantum mechanics, lasers, fiber optics and different kinds of engineering materials.
- To correlate the theoretical physics principles with application oriented engineering studies.

Unit – I
Quantum Mechanics: Limitations of Classical Mechanics – Photoelectric Effect - Einstein’s Photoelectric Equation - Planck’s Quantum Theory (Qualitative) - Wave Particle Duality - de-Broglie’s Wave – Heisenberg’s Uncertainty Principle - Time Independent and Time Dependent Forms of Schrödinger Wave Equation – Particle in a Box (1D) – Quantum Mechanical Tunneling – Scanning Tunneling Microscope -Quantum Well, Quantum Wire and Quantum Dot.

Unit – II

Unit – III

Unit – IV
Semiconductor Physics: Intrinsic & Extrinsic Semiconductors -Direct and Indirect Band Gap Semiconductors - Carrier Concentration of Intrinsic Semiconductors – Extrinsic Semiconductors - Carrier Concentration of p and n Type Semiconductors - Hall Effect: Determination of Carrier Concentration & Mobility.
TEXT BOOKS:

REFERENCE BOOKS:

NPTEL Links:
1. Quantum Physics: https://nptel.ac.in/courses/122106034/
2. Lasers: https://nptel.ac.in/courses/115101008/
3. Fiber Optics: https://nptel.ac.in/courses/115107095/
5. Magnetic Materials: https://nptel.ac.in/courses/115104088/42
6. Semiconductor Physics: https://nptel.ac.in/courses/115102025/

Learning Outcomes:
Upon successful completion of each unit, the learner will be able to:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Learning Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit I</td>
<td>Distinguish the classical limits and existence of quantum nature of particles.</td>
</tr>
<tr>
<td>Unit II</td>
<td>Classify the different types of lasers, optical fibers including their applications.</td>
</tr>
<tr>
<td>Unit III</td>
<td>Recall the preambles of dielectrics and to comprehend different types of polarizations in dielectrics, to identify the applications of ferroelectric materials in various engineering fields, and to distinguish the different types of magnetic materials.</td>
</tr>
<tr>
<td>Unit IV</td>
<td>Recognize intrinsic, extrinsic, elemental and compound semiconductors.</td>
</tr>
</tbody>
</table>

OVERALL LEARNING OUTCOME:
Upon successful completion of this course, the learner will be able to apply the concepts of quantum mechanics & semiconductor physics and the principles of lasers & optical fibers for various engineering applications.
ENGINEERING PHYSICS LABORATORY

Course Objectives:

The objectives of the course are to help students to,

1. Gain practical knowledge through experimental methods and find correlation with physics theory
2. Learn the usage of electrical and optical systems for various measurements
3. Apply the analytical techniques and graphical analysis to the experimental data.

List of Experiments

1. LASER Grating – Determination of wavelength using diffraction grating.
2. Finding the particle size using LASER
5. Photoelectric effect – Determination of Planck’s constant.
6. Diffraction of Light by Ultrasonic waves.
7. Ultrasonic Interferometer – Determination of velocity of ultrasonic waves in different liquids.
8. Ultrasonic Testing of Materials (NDT)
9. Superconductivity- measurement of transition temperature
10. Measurement of dielectric constant – Parallel plate capacitor method
11. Hall Effect - Determination of mobility and carrier concentration for semiconductors.
12. Band gap measurement of semiconductors by Four Probe Method.
15. Electron Spin Resonance- Determination of g-factor

LEARNING OUTCOMES

| Expts.1-4 | Comprehend the different physical parameters of optics with ordinary light and lasers |
| Expt. 5 | Realize photoelectric effect and its applications |
| Expts.6-8 | Perceive the production of ultrasonic waves through inverse piezoelectric effect and demonstrate the applications of ultrasounds |
| Expt. 9 | Identify the transition temperature of any given superconductors |
| Expt. 10 | Distinguish active and passive dielectrics based on the measured dielectric constants |
| Expts. 11-13 | Understand the principle of semiconductors and thereby to measure energy band gap and carrier concentration of semiconductors |
| Expts. 14-15 | Recognize the preambles and characteristics of ferromagnetic materials and to realize the importance of electron spin resonance |
Course Code: CHY101  
Semester: I / II

ENGINEERING CHEMISTRY

Course Objectives:
The main objectives of the course are to impart knowledge on the fundamental chemistry principles involved in several important engineering materials used in industry. In particular, the learners will study the basic chemistry concepts and industrial applications of lubricants, redox reactions, water treatment technologies and advanced engineering materials. The semi theory – semi lab format of this course will also enable the learners to get hands-on experience on the principles discussed during the theory classes in the laboratory sessions where they will perform experiments to understand the applications of these concepts in engineering.

UNIT – I  
11 Periods

WATER TREATMENT TECHNOLOGY

UNIT – II  
11 Periods

REDOX REACTIONS AND ELECTROCHEMISTRY

UNIT –III  
12 Periods

ASSOCIATIVE INTERACTIONS AND LUBRICANTS

Lubricating oils – Acid value, Saponification value, Steam emulsification number.

UNIT – IV 11 Periods

ADVANCED MATERIALS
Nanomaterials-Classification. Synthesis–Top down method (Ball milling), Bottom up methods – wet chemical, physical and chemical vapor deposition, Sol-Gel method, Self-assembly (DNA-directed self-assembly of AuNPs), Applications of nanomaterials - AuNPs based anti-cancer agents, ZnO and Fe3O4 based memristors, Water purification using AgNPs, TiO2 based self-cleaning glass.

TEXTBOOK

REFERENCES

LEARNING OUTCOMES
Upon completion of the theoretical sessions of this course, the learners will be able to:

<table>
<thead>
<tr>
<th>Unit –I</th>
<th>Select and employ suitable water treatment technologies for domestic and industrial applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit –II</td>
<td>Demonstrate an understanding of the fundamental concepts used in electrochemistry Describe various energy storage devices and emerging technologies Apply the principles of electrochemistry to design corrosion control measures</td>
</tr>
<tr>
<td>Unit –III</td>
<td>Identify the various intermolecular interactions existing in the given system Demonstrate an understanding of lubricants, their properties and industrial applications</td>
</tr>
<tr>
<td>Unit –IV</td>
<td>Become familiar with the various concepts of composite materials and their properties as well as on the synthesis and applications of nanomaterials in various sectors</td>
</tr>
</tbody>
</table>
ENGINEERING CHEMISTRY LABORATORY

SESSION OBJECTIVES
This session aims to provide the learners hands-on-training on the practical applications of the concepts learnt in the theoretical sessions on water treatment, electrochemistry, lubricants, composites and nanomaterials using simple chemical methods. The course will also train the learner to observe good lab practices, record readings and graphically represent the results, as well as analyse and interpret the influence of reaction conditions on the results.

LIST OF EXPERIMENTS

1. Determination of alkalinity and chemical oxygen demand of effluent water
2. Determination of percentage of available chlorine in the given sample of bleaching powder by iodometry
3. Complexometric analysis:
   a. Estimation of nickel/ aluminium /zinc
   b. Determination of total hardness in the given water by EDTA method
4. Measurement of single electrode potential and construction of an electrochemical cell
5. Applications of Nernst equation:
   a. Estimation of Fe^{2+}, Cu^{2+} or Ce^{2+}
   b. Estimation of amount of HCl in a given solution by pH meter
   c. Determination of concentration of given electrolyte
6. Conductometric titration:
   a. Strong acid/Strong base
   b. Strong acid/Weak base
   c. Weak acid/Strong base
7. Adsorption of acetic acid or oxalic acid by activated charcoal
8. Estimation of iodine value and acid value of oil
9. Determination of viscosity of polymer composites using Oswald viscometer
10. Synthesis of silver nanoparticles by chemical reduction
11. Electroplating/Anodization at a production facility – An example of electrolysis (Demonstration)
12. Preparation of soap (Demonstration)

LEARNING OUTCOMES

Upon completion of the laboratory sessions, the learner will be able to:

<table>
<thead>
<tr>
<th>Expt.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Measure the quantitative capacity required to neutralize the water and quantify oxidizable chemical impurities present in waste water</td>
</tr>
<tr>
<td>2</td>
<td>Evaluate the quality of bleaching powder by iodometric titration</td>
</tr>
<tr>
<td>3</td>
<td>Employ complexometric titrations to quantify anthropogenic metals or estimate total hardness of a water sample</td>
</tr>
<tr>
<td>4</td>
<td>Measure the single electrode potential of a particular electrode Construct an electrochemical cell and demonstrate its utility</td>
</tr>
<tr>
<td>5</td>
<td>Correlate redox potential, Nernst equation, relationship between pH and redox potential to estimate the strength of various redox couples and given electrolytes Apply the practical aspects of first derivatives which they learn in their introductory calculus lessons</td>
</tr>
<tr>
<td>Expt.6</td>
<td>Estimate the strength of given acid or base using conductance measurements</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Expt.7</td>
<td>Demonstrate the interaction between adsorbate and adsorbent and estimate the amount of given acid adsorbed by the charcoal</td>
</tr>
<tr>
<td>Expt.8</td>
<td>Estimate two important properties of oils and select appropriate oil for edible or lubrication applications</td>
</tr>
<tr>
<td>Expt.9</td>
<td>Demonstrate the influence of additives on the change in the physical properties of polymer composites</td>
</tr>
<tr>
<td>Expt.10</td>
<td>Synthesize metal nanoparticles by simple wet chemical method and demonstrate the influence of capping agents on their stability</td>
</tr>
<tr>
<td>Expt.11</td>
<td>Employ a technology to apply thin coherent metal coating on a metal surface using the principle of electrolysis</td>
</tr>
<tr>
<td>Expt.12</td>
<td>Produce a value-added product from readily available precursors using saponification reaction</td>
</tr>
</tbody>
</table>
Course Code: EEE101
Semester: I / II

BASIC ELECTRICAL ENGINEERING

Course Objectives:
1. To impart basic knowledge of DC and AC circuits
2. To understand the construction and operation of DC machines
3. To understand the construction and operation of transformers
4. To provide an insight into the electric power supply systems and various types of electrical loads

UNIT – I
Electric Circuits
Direct Current (DC) Circuits
Ohm’s law, Kirchhoff’s laws, Series and parallel circuits, Ideal and practical voltage and current source, Mesh and Nodal analysis, Source transformation, Star delta transformation.

Alternating Current (AC) Fundamentals
Definition of AC quantities, Form factor, Peak factor, Analysis of steady-state AC circuits with R, L, C, R-L, R-C and R-L-C elements, Complex notation, Phasor diagrams, Power and power factor.

UNIT – II
DC Machines
Definition of MMF, Flux, Reluctance, Flux density, Comparison between electric and magnetic circuits, Lenz’s law, Dynamically induced EMF, Force on a current carrying element in a magnetic field, Fleming’s right and left hand rules.
Basic structure and construction of DC machines, Working principle of motors and generators, Types and its application, Need of starters and its type.

UNIT – III
Single Phase Transformer
Faraday’s Law of Electromagnetic Induction, Statically Induced EMF, Self and Mutual Inductances, Coefficient of coupling.
Construction and principle of operation of transformers, EMF equation, Application of transformers, Voltage regulation, Losses and efficiency.

UNIT – IV
Electrical Supply System
Domestic wiring, Basic principles of Earthing, General safety requirement as per IE rules, Basics of electrical power generation, Transmission system, Distribution system.

Electrical Loads
Single phase and three phase loads, Power rating, Calculation of energy consumption.
TEXTBOOKS

REFERENCE

ONLINE MATERIALS
1. NPTEL – [http://nptel.ac.in/courses/108108076/1](http://nptel.ac.in/courses/108108076/1)

LAB EXERCISES
1. Verification of basic laws of electric circuits
2. Verification of voltage division and current division rules
3. Mesh and node analysis
4. Voltage–current relationship in a R-L & R-C series circuits and to determine the power factor of the circuit
5. Domestic wiring
6. Electric power supply system
7. Calculation of energy consumption for various loads
8. Study of statically and dynamically induced EMF

LEARNING OUTCOMES

Upon successful completion of each unit, the learner will be able to:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit II</td>
<td>Understand the generation of dynamically induced EMF in a DC generator and explain the construction and operation of DC machines.</td>
</tr>
<tr>
<td>Unit III</td>
<td>Understand the generation of statically induced EMF in a transformer and explain the construction and operation of transformers.</td>
</tr>
<tr>
<td>Unit IV</td>
<td>Demonstrate simple domestic wiring, summarise general safety requirements as per IE rules, understand electric power system and classify various types of loads.</td>
</tr>
</tbody>
</table>
Course Code: EIE101R01
Semester: I /II

**BASIC ELECTRONICS ENGINEERING**

**Course Objectives:**
1. To familiarise the fundamental concepts of electronic devices like semiconductor diodes, BJT, JFET, MOSFET and Op-Amp
2. To design a regulated power supply unit to power various circuits
3. To introduce the basic concepts of measuring devices and its measurements

**UNIT – I**

**Semiconductor Diode**


**UNIT - II**

**Bipolar Junction Transistor**

- BJT: Construction – working of PNP/NPN – input and output characteristics – common emitter configuration – common base configuration – common collector configuration - DC load line – Q-Point (fixed bias only) – Transistor as an amplifier and switch

**UNIT - III**

**Field Effect Transistor**

- JFET: Construction – working – drain and transfer characteristics – Depletion mode

**UNIT - IV**

**Power Supply and Measuring Instruments**

- Basic building blocks of regulated power supply, Series and shunt voltage regulator using Transistor.
- Permanent Magnet Moving Coil (PMMC) – Basic DC voltmeter and DC ammeter
- Oscilloscope: Block diagram – Measurement of voltage, current, phase and frequency using CRO – Digital Storage Oscilloscope: Block diagram

**TEXTBOOK**


**REFERENCES**

2. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, 1st edition, Pearson,

UNIT-WISE LEARNING OUTCOMES

Upon successful completion of each unit, the learner will be able to:

<table>
<thead>
<tr>
<th>Unit</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit I</td>
<td>Outline the working principle of semiconductor diodes</td>
</tr>
<tr>
<td></td>
<td>Apply the concept of diodes for different applications</td>
</tr>
<tr>
<td>Unit II</td>
<td>Illustrate the working of BJT, analyze the circuit configuration and characteristics in active region of operation.</td>
</tr>
<tr>
<td></td>
<td>Apply the concept to determine the Q-point, analyze the transistor as an amplifier and switch</td>
</tr>
<tr>
<td>Unit III</td>
<td>Demonstrate the working of JFET, E-MOSFET and D-MOSFET</td>
</tr>
<tr>
<td></td>
<td>Analyze the characteristics of JFET and MOSFET</td>
</tr>
<tr>
<td></td>
<td>Analyze the MOSFET switch and CMOS as an inverter</td>
</tr>
<tr>
<td>Unit IV</td>
<td>Construct the regulated power Supply unit</td>
</tr>
<tr>
<td></td>
<td>Explain the working of oscilloscope and PMMC instruments</td>
</tr>
</tbody>
</table>

List of Experiments:
1. V-I characteristics of P-N junction diode
2. V-I characteristics of Zener diode
3. Half wave rectifier and full wave rectifier (center tapped) using P-N junction diode
4. Biased Clippers using P-N junction diode
5. Zener diode as voltage regulator
6. Input and output characteristics of common emitter configuration
7. Drain and transfer characteristics of JFET
8. Measurement of frequency and phase using CRO

COURSE LEARNING OUTCOMES

Upon completion of this course, the learners will be able to:

- Infer the characteristics of semiconductor devices and use them for different applications.
- Design a voltage regulator using Zener diode.
- Make use of CRO to measure various electrical parameters
Course Code: CIV 101  
Semester: I / II

BASIC CIVIL ENGINEERING

Course Objectives:
1. By successfully completing this course, the student will be able to assess the requirements of a construction project, including principles and by-laws, building materials and their properties
2. Student will be able to identify the basis of methods of surveying
3. Student will understand the fundamentals of road, dams, water management and irrigation techniques

UNIT – I  
Building Planning  
Branches of civil engineering, Site selection, Principles of planning, Planning regulations and By-laws.

Civil Engineering Materials  
Properties, types and uses of civil engineering materials - Bricks, Stones, Aggregates, Cement, Cement mortar, Concrete, Steel and Timber.

UNIT – II  
Building Construction  
Loads acting on structure, types of construction – Load bearing walled structures and framed structures, Bearing capacity of soil, foundations – functions and its types, Superstructure and its components, Brick and stone masonry construction, Technical terms related to doors, windows and stairs.

Road Construction  
Classification of roads - rigid and flexible pavements, functions of camber and super-elevation.

UNIT – III  
Geographical Measurement  
Principles of survey, measurement of distance by chain and tape, area calculation, prismatic compass, measurement of bearing and conversions, the study of levels, benchmarks and determination of reduced levels, contour and their characteristics, Introduction to remote sensing.

UNIT – IV  
Water Management  
Definition of watershed, necessity of watershed management works, different structures involved in watershed management, Roof top rainwater harvesting and ground water recharge, Classifications of dams, typical cross section of gravity dam and zoned earthen embankment, Necessity of irrigation, benefits and types of irrigation.

TEXTBOOKS

REFERENCES
**ONLINE MATERIALS**

1. NPTEL - [http://nptel.ac.in/syllabus/syllabus.php?subjectId=105104101](http://nptel.ac.in/syllabus/syllabus.php?subjectId=105104101)
2. NPTEL - [http://nptel.ac.in/syllabus/syllabus.php?subjectId=105107122](http://nptel.ac.in/syllabus/syllabus.php?subjectId=105107122)
3. NPTEL - [http://nptel.ac.in/syllabus/syllabus.php?subjectId=105102088](http://nptel.ac.in/syllabus/syllabus.php?subjectId=105102088)
4. NPTEL - [http://nptel.ac.in/downloads/105105110](http://nptel.ac.in/downloads/105105110)

**LEARNING OUTCOMES**

<table>
<thead>
<tr>
<th>Unit I</th>
<th>Student will be able to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Explain the planning regulations and by-laws.</td>
</tr>
<tr>
<td></td>
<td>• Classify civil engineering materials based on their properties and uses.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit II</th>
<th>Student will be able to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Identify the loads acting on a structure.</td>
</tr>
<tr>
<td></td>
<td>• Explain the functions of the sub-structure and super-structure elements of a building.</td>
</tr>
<tr>
<td></td>
<td>• Classify the roads and explain the functions of flexible and rigid pavements.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit III</th>
<th>Student will be able to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Explain the fundamental principles of surveying</td>
</tr>
<tr>
<td></td>
<td>• Measure length, orientation, rise/fall using chain, compass, dumpy level, total station and their allied instruments.</td>
</tr>
<tr>
<td></td>
<td>• Compute area of a land and calculate reduced levels of different stations on the land.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit IV</th>
<th>Student will be able to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Explain the fundamental principles of watershed management and rain water harvesting.</td>
</tr>
<tr>
<td></td>
<td>• Classify dams and explain their functions.</td>
</tr>
<tr>
<td></td>
<td>• Explain the principle and methods of irrigation.</td>
</tr>
</tbody>
</table>
BASIC CIVIL ENGINEERING LAB

1. Drawing standard – BIS - Lettering, dimensioning, type of lines, scales, symbols and conventions
2. Drawing of measured laboratory/hall (with furniture layout)
3. Line plan of residential building – scheme development
4. Typical section of a single storey building
5. Study of various bonds using bricks
6. Pipe fittings and fixtures in field
7. Introduction to surveying equipment
8. Exercise on Total station (measurement of distances, horizontal and vertical angles)
9. Parallelogram Law of forces
10. Lami’s Theorem
11. Equilibrium of parallel forces
12. Coefficient of friction and Angle of repose
13. Centre of gravity for irregular lamina
14. A report based on site visit to construction site – Assignment.

LEARNING OUTCOMES

| Expt 1 | Student will be able to apply the BIS drawing standards and specifications |
| Expt 2 | Student will be able to construct a plan using field measurements |
| Expt 3 | Student will be able to design a line plan for a residential building |
| Expt 4 | Student will be able to construct the cross sectional view of framed structures |
| Expt 5 | Student will be able to construct various bonds using bricks |
| Expt 6 | Student will be able to demonstrate the types of pipe fittings and joints in the field |
| Expt 7 | Student will be able to demonstrate various surveying instruments |
| Expt 8 | Student will be able to employ total station for terrain measurements |
| Expt 9 | Student will be able to find the resultant of two forces inclined to one another |
| Expt 10 | Student will be able to check for equilibrium of three concurrent forces |
| Expt 11 | Student will be able to check data sufficiency of a given system of parallel forces |
| Expt 12 | Student will be able to calculate the coefficient of friction at the interface of two materials; will be able to assess the maximum angle at which a granular material can be piled |
| Expt 13 | Student will be able to locate the centre of gravity of an irregular lamina |
| Expt 14 | Student will witness construction activities of different elements and structures and understand the complexity |
BASIC MECHANICAL ENGINEERING

Course Objective:
To provide an overview of basic principles and applications of Mechanical Engineering with practical exposure on various basic engineering practices and manufacturing processes.

UNIT – I                  8 Periods
MANUFACTURING TECHNOLOGY (MACHINING AND FORMING)
Machining – Operations on Lathe (Turning, Facing, Knurling, Forming, Drilling, Boring, Reaming, Counter Boring, Chamfering and Grooving Operations Only), Drilling (Drilling, Reaming, Boring, Counter Boring, Counter Sinking, Spot Facing and Tapping Operations Only) and Shaping (Shaping Horizontal Surface, Shaping Vertical Surface, Shaping Angular Surface, Shaping Slots, Grooves & Keyways And Shaping Irregular Surface Operations Only), Introduction to CNC Machining.


UNIT – II                 7 Periods
MANUFACTURING TECHNOLOGY (FOUNDRY AND WELDING)
Foundry – Pattern Making (Single Piece, Split Pieces and Core) – Casting (Preparation of Green Sand Mould, Pouring of Molten Metal, Fettling and Cleaning).

UNIT – III                 7 Periods
REFRIGERATION & AIR-CONDITIONING AND I.C. ENGINES
Refrigeration and Air-Conditioning – Principles - Operation of Refrigerator (Vapour Compression System only) and Air-Conditioner (Window and Central Air Conditioning Systems).


UNIT – IV                  8 Periods
ENERGY RESOURCES AND POWER PLANTS
Conventional and Non-Conventional Energy Resources – Applications.
Power Plants – Steam, Hydel, Nuclear, Gas Turbine and Combined Cycle Power Plants.
Steam Boilers – High Pressure Boilers (Babcock & Wilcox Boiler, La-Mont Boiler and Benson Boiler Only).
Steam Turbines – Types, Operating Principle (Simple Impulse, Reaction, Velocity Compounding, Pressure Compounding and Pressure – Velocity Compounding).
List of Experiments
1. Square / Angle Fitting by filing of Steel flats
2. Fabrication of Cylinder /Tray from G. I sheet
3. Conversion of round rod to square / Hexagonal Rod by hot Forging
4. Welding of Lap and Butt joints
5. Preparation of Mould cavity for Solid & Split Patterns
6. Dismantling, study and assembly of I.C. Engine
7. Dismantling, study and assembly of Gear Box
8. Study of various parts, different operations and Demonstration on Lathe
9. Study of various parts, different operations and Demonstration on Shaper.
10. Study of various parts, different operations and Demonstration on Drilling Machine
11. Study and Demonstration of CNC Turning and Machining Center
12. Study and demonstration of 3D printing machines

LEARNING OUTCOMES

Upon successful completion of the course, the learner will be able to:

<table>
<thead>
<tr>
<th>Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit I</strong></td>
</tr>
<tr>
<td><strong>Unit II</strong></td>
</tr>
<tr>
<td><strong>Unit III</strong></td>
</tr>
<tr>
<td><strong>Unit IV</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Identify different tools, select and apply suitable machining processes</td>
</tr>
<tr>
<td>▪ Demonstrate the working of IC engine and transmission system</td>
</tr>
<tr>
<td>▪ Explain CNC machining and additive manufacturing technology</td>
</tr>
</tbody>
</table>

TEXTBOOK

REFERENCES

ONLINE MATERIALS
1. [http://nptel.ac.in/syllabus/syllabus.php?subjectId=112107144](http://nptel.ac.in/syllabus/syllabus.php?subjectId=112107144)
2. [http://nptel.ac.in/syllabus/syllabus.php?subjectId=112108148](http://nptel.ac.in/syllabus/syllabus.php?subjectId=112108148)
3. [http://nptel.ac.in/syllabus/syllabus.php?subjectId=112104113](http://nptel.ac.in/syllabus/syllabus.php?subjectId=112104113)
ENGINEERING MECHANICS

Course Objectives:
1. The learner, after successfully completing the course, will be able to recognize the importance of mathematics in engineering and solve problems in rigid body mechanics in a logically consistent and step-wise manner.
2. The basic concepts dealt in this course will enable the students to grasp higher level topics in solid, structural, fluid, aero-, bio-mechanics, machine design and electrical and robotic devices.

UNIT – I 12 Periods
Force Systems
Introduction to simple vector operations; Frames of Reference and Coordinate Systems; Newton’s Laws; Particles and rigid bodies. Concept of force, classification of force systems (linear and moments), combining forces (resultant), nullifying the effect of force systems (equilibrant) in vector forms, including moments about a point, about a line, resolution of a force into a force and moment and reverse(parallel shifting of forces)and wrench. Forces in two dimensions (Free Body Diagrams) - Parallelogram Law, Lami’s theorem, Triangular Law, polygon law, moments about a point, Varignon’s theorem, moment about a line, resultants, equilibrant, resolution of a force into a force and a couple and vice versa.

UNIT – II 12 Periods
Properties of lines, areas, volumes
Concept of centroid, center of mass, center of gravity of standard shapes including semi-circular and segmental arcs (lines), circles, quadrants, parabolas, square/rectangle (areas), cubes, spheres, hemispheres (volumes), combined sections of the above. Concept of second moment of area, polar second moment of area, parallel axis theorem, perpendicular axis theorem, radius of gyration. Calculations of Second Moment of Area of circles, segments of circles, squares, rectangles, combined shapes. Applications of Pappus and Guldinus theorems.

UNIT – III 12 Periods
Unit III – Friction (Static friction only)
Concept of friction; its uses; laws of friction; various types of friction (block, block-on-block - horizontal and inclined surface -, screw, ladder, wedge) presented in a unified approach (anchored to FBDs) to solve friction problems. Belt friction (static) treated separately.

UNIT – IV 9 Periods
Dynamics – kinematics and kinetics

TEXTBOOK
REFERENCES

ONLINE MATERIALS
1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=122104014

LEARNING OUTCOMES

<table>
<thead>
<tr>
<th>Unit I</th>
<th>The learner will be able to identify the different frames of reference, coordinate systems; identify whether a body is in equilibrium, in 3D and 2D systems, for particles (dimensionless)/rigid bodies (undeformable).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit II</td>
<td>The learner will be able to calculate the geometric properties of lines, areas, surfaces and volumes and solve problems involving surface of revolution and volume of revolution. The learner can calculate the second moment of area about any given axis for standard sections and combinations of these.</td>
</tr>
<tr>
<td>Unit III</td>
<td>The learner will be able to apply concepts of friction to various situations such as bodies in contact, (horizontal and inclined surfaces), screw, ladder, and wedge. The learner will be able to calculate belt friction (static friction only).</td>
</tr>
<tr>
<td>Unit IV</td>
<td>The learner will be able to solve equations of motions for a given problem using. D’Alembert’s principle, work-energy and impulse-momentum principles. The learner can solve projectile motion.</td>
</tr>
</tbody>
</table>
Course Code: CIV 103  
Semester: I / II  

ENGINEERING GRAPHICS  

Course Objectives:  
The student will possess the skill for efficient drafting depending on the operational function in order to perform day-to-day activity and in creating simple engineering designs of Industrial components using AutoCAD Software.

UNIT – I  
**Introduction to Engineering drawing & Drafting Software.**  
10 Periods  
Principles of engineering graphics and their significance – Overview of Computer graphics-introduction to drafting software – Demonstrating knowledge of the theory of CAD software - Menu System, Toolbars (commands- Draw, Modify and Dimension)  
Geometrical constructions – Curves used in engineering practice –conic sections, Cycloidal curves, Involute – square and circle.

UNIT – II  
**Orthographic projection**  
10 Periods  
Principles –First angle projections-projection of points - straight lines-Inclined to both the principal planes – true lengths and true inclinations by rotating line method.

Projection of solids inclined to one reference plane- prisms, pyramids, cylinder, and cone – change of position method.

UNIT – III  
**Section, Intersection and Development of Surfaces of solids**  
10 Periods  
Section planes perpendicular to one plane and parallel or inclined to other plane true shape of section- Intersection of surfaces-Development of lateral surfaces of prisms, cylinders, cone and pyramids.

UNIT – IV  
**Isometric projection**  
15 Periods  
Principles of Isometric projection – construction of isometric view of prisms, cylinders, pyramid and cones- Construction of isometric view from orthographic views of industrial objects (2D to 3D).

**LIST OF EXERCISES USING AUTOCAD SOFTWARE:**  
1. Construction of ellipse and parabola.  
2. Orthographic projections of simple solids.  
3. Sectional orthographic views of a cone and cylinder  
4. Intersection of cylinder to cone.  
5. Development of lateral surfaces of solids.  
6. Isometric view of prism, cone and industrial objects.
XXXIV Academic Council Meeting

TEXTBOOKS

REFERENCES

ONLINE MATERIALS
1. NPTEL- http://nptel.ac.in/courses/112104031/1
2. NPTEL- http://nptel.ac.in/courses/112103019/

LEARNING OUTCOMES

<table>
<thead>
<tr>
<th>Unit</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit I</td>
<td>The learner will be able to draw plane and special curves which are of great importance to engineers using Auto CAD software.</td>
</tr>
<tr>
<td>Unit II</td>
<td>The learner will be able to draw the projection of solids in the first quadrant.</td>
</tr>
<tr>
<td>Unit III</td>
<td>The learner will be able to draw sectional views, intersection of surfaces of solids and development of lateral surfaces of solids.</td>
</tr>
<tr>
<td>Unit IV</td>
<td>The learner will be able to draw isometric projection of simple solids and will be able draw isometric view of the industrial object from orthographic projection.</td>
</tr>
</tbody>
</table>
Course Code: MEC102  
Semester: I / II

INTRODUCTION TO ENGINEERING DESIGN

Course Objective:  
To familiarize the students with Engineering Design process and induce design thinking.

UNIT – I  
Introduction: Engineering design – meaning and significance  
7 Periods
Definition, considerations and assumptions; designer, client and user triangle; design vocabulary: design levels and design process

UNIT – II  
Problem Definition: Needs and goals  
8 Periods
Objective tree – illustrative examples; market analysis and information gathering; identification of needs and user requirements; Functions and specifications.


UNIT – III  
Conceptual design: generation of alternative concepts  
8 Periods
Design space – Morphological chart and design thinking; Brainstorming – creativity – developing concepts from functions; Illustrative cases.

UNIT – IV  
Concepts evaluation and selection  
7 Periods
Decision matrix; applying metrics to objectives towards selection of preferred concepts.

Numerical evaluation matrices - Priority checkmark method - The best-of-class chart.

TEXTBOOKS

LEARNING OUTCOMES

Upon successful completion of the course, students will be able to identify problems, gather data, prepare need statements, generate alternative conceptual solutions and choose the best concept.
Course code: MAT102R01  
Semester: II  

ENGINEERING MATHEMATICS - II  
(COMMON FOR ALL BRANCHES OF ENGINEERING)  

Course Objectives:  
The course aims to train the learner to:  
- Extend their knowledge of derivatives to find curvature, evolutes etc. and measure extreme values of a given function of several variables.  
- Employ various techniques for solving differential equations to solve problems arising in different engineering fields.  
- Understand the directional derivative and gradient of a function, illustrate their geometric meaning with the aid of sketches and apply gradients to solve problems involving normal vectors to level surfaces.  
- Apply vector integral theorems to interpret the work done by a force, understand the physical interpretations of divergence and curl of a vector.

UNIT – I: Differential Calculus and Functions of Several variables  

Functions of several variables: Maxima and Minima of functions of two or more independent variables - Lagrange’s method of undetermined multipliers.

UNIT – II : Ordinary Differential Equations  

Differential equations of first order and first degree - Bernoulli’s equation – Exact equation - First order and higher degree equations - solvable for p, x, y and Clairaut’s form - Higher order differential equations with constant coefficients – Method of variation of parameters - Euler’s differential equation with variable coefficients – Simultaneous differential equations with constant coefficients.  

UNIT- III : Vector Differentiation  

Differentiation of vectors – Velocity and acceleration - Vector differential operator: Gradient, Divergent and Curl operators - Directional derivative - Scalar potential of a vector function - Irrotational and Solenoidal vector fields – Vector operator identities(without proof)  
Flow of a compressible fluid – Condition of incompressibility - Conservative forces.

UNIT – IV: Vector Integration  

Line Integrals – Surface and Volume integrals – Vector integral theorems: Green’s theorem for scalar point functions, Gauss divergence theorem, Stoke’s theorem (without proof) – verification and evaluation.  
Work done by a force - Determination of potential function - Area of a plane region as a line integral over the boundary.
TEXTBOOKS

REFERENCES

ONLINE MATERIALS
1. https://nptel.ac.in/courses/111104092/
2. https://nptel.ac.in/courses/111104085/
3. https://nptel.ac.in/courses/111108081/
4. https://nptel.ac.in/courses/111104031/
5. https://nptel.ac.in/courses/11105122/
7. https://nptel.ac.in/courses/11105122/

UNIT-WISE LEARNING OUTCOMES
Upon completion of each unit, the learner will be able to

<table>
<thead>
<tr>
<th>Unit</th>
<th>Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit I</td>
<td>Apply the concepts differentiability to study the curvature and find the optimum value of function of several variables.</td>
</tr>
<tr>
<td>Unit II</td>
<td>Find the solution of first and higher order differential equations.</td>
</tr>
<tr>
<td>Unit III</td>
<td>Understand the basic knowledge on vector differentiation and work with the different emerging fields in the engineering domain</td>
</tr>
<tr>
<td>Unit IV</td>
<td>Apply vector integral theorems in various engineering disciplines</td>
</tr>
</tbody>
</table>
## COURSE LEARNING OUTCOMES
After the successful completion of the course, the student will be able to:

<table>
<thead>
<tr>
<th>CO No.</th>
<th>Course Outcome</th>
<th>Knowledge Level</th>
</tr>
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<tr>
<td>CO 1.</td>
<td>Determine the Envelopes and Evolutes of various families of curves.</td>
<td>K3</td>
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<tr>
<td>CO 2.</td>
<td>Measure the extreme values of a given function of two variables</td>
<td>K3</td>
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<td>CO 3.</td>
<td>Identify appropriate methods to solve various differential equations</td>
<td>K2,K3</td>
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<td>CO 4.</td>
<td>Solve differential equations governed by various physical phenomena</td>
<td>K3</td>
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<tr>
<td>CO 5.</td>
<td>Evaluate derivatives over vector fields</td>
<td>K3</td>
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<tr>
<td>CO 6.</td>
<td>Identify solenoidal and irrotational vectors</td>
<td>K2</td>
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<tr>
<td>CO 7.</td>
<td>Evaluate integrals over vector fields to find work done, potential function etc.</td>
<td>K3</td>
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Course Code: CSE201  
Semester: II  

OBJECT ORIENTED PROGRAMMING IN C++

Course Objective:
This course will help the learner to employ object oriented concepts for developing programs catering to different applications.

UNIT – I  
Introduction
Fundamentals of object oriented programming - procedure oriented programming vs. Object Oriented Programming (OOP), Object Oriented Programming concepts - classes, reusability, encapsulation, inheritance, polymorphism, dynamic binding, message passing.

C++ Programming Basics
Output using cout, directives, input with cin, type bool, Manipulators, type conversions.

Functions
Returning values from functions, reference arguments, overloaded functions, inline functions, default arguments, returning by reference.

UNIT – II  
Objects and Classes
Implementation of classes in C++, C++ objects as physical objects, C++ objects as data types, constructor, objects as function arguments, returning object from function, default copy constructor, structures and classes, objects and memory, static class data, const data and classes.

Arrays and String Arrays Fundamentals
Arrays as class member data, arrays of objects, strings, standard C++ string class.

UNIT – III  
Operator Overloading
Overloading unary operators, overloading of binary operators, data conversion, pitfalls of operators overloading and conversion, keywords explicit and mutable.

Inheritance
Concept of inheritance, derived class and base class, derived class constructors, overriding member function, class hierarchies, public and private inheritance, levels of inheritance, multiple inheritance, ambiguity in multiple inheritance, aggregation: classes within classes, inheritance and program development.

UNIT – IV  
Pointers
Addresses and pointer, address-of operator &, pointer and arrays, pointer and fraction, pointer and C- type string.

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<td>3</td>
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<td>2</td>
<td>4</td>
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Memory Management
New and delete, pointers to objects, debugging pointers

Virtual Functions
Virtual functions, friend functions, static functions, assignment and copy initialization, this
pointer, dynamic type information.

Streams and Files
Stream classes, stream errors. disk file I/O with streams, file pointers, error handling in file I/O,
file I/O with member functions, overloading the extraction and insertion operators

TEXTBOOKS

REFERENCES
   2014.

ONLINE MATERIAL
1. MIT Courseware – https://ocw.mit.edu/courses/electrical-engineering-and-computer-
science/6-s096-introduction-to-c-and-c-january-iap-2013/index.htm

LEARNING OUTCOMES

Upon successful completion of each unit, the learner will be able to

<table>
<thead>
<tr>
<th>Unit I</th>
<th>▪ Describe the object oriented concepts</th>
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<td>Unit II</td>
<td>▪ Employ the concepts of classes and objects for a given application</td>
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<td>Unit III</td>
<td>▪ Create user defined data types with overloaded operators</td>
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<td>▪ Develop applications by making use of inheritance</td>
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<td>Unit IV</td>
<td>▪ Employ pointers for better memory management</td>
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<td>▪ Develop applications using file streams</td>
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LIST OF LAB EXERCISES

1. Basic C++ Programs using Input / Output, branching and Loops
2. Programs using functions with default arguments, inline functions and function
   overloading
3. Programs using classes with constructors and destructors
4. Programs using array as data members of a class and array of objects
5. Programs using String class
6. Programs using operator overloading
7. Programs for data conversion using overloading
8. Programs using inheritance
9. Programs using virtual functions and friend functions
10. Programs using file Input / Output