SASTRA

ENGINEERING · MANAGEMENT · LAW · SCIENCES · HUMANITIES · EDUCATION

DEEMED TO BE UNIVERSITY

(U/S 3 OF THE UGC ACT, 1956)

THINK MERIT | THINK TRANSPARENCY | THINK SASTRA

Scheme of Study and Syllabus

for

First Year B. Tech. / M. Tech. (5 – Year Integrated)

Degree Programmes

for

Students admitted from 2019-20

I Semester

Course Code	Course Name	No of Contact Hours / Week			Credits
		L	T	P	
ENG101/ BIT101R01	Technical Communication	1	0	2	2
	Biology for Engineers	2	0	0	
MAT101	Engineering Mathematics – I	3	1	0	4
CSE101	Problem Solving & Programming in C	3	0	2	4
PHY101R01 / CHE101	Engineering Physics /	3	0	2	4
	Engineering Chemistry	3	0	2	4
EEE101 / EIE101	Basic Electrical Engineering /	2	0	2	3
	Basic Electronics Engineering	2	0	2	3
CIV101/ MEC101	Basic Civil Engineering /	2	0	2	3
	Basic Mechanical Engineering	2	0	2	3
CIV102 / CIV103	Engineering Mechanics /	2	1	0	3
	Engineering Graphics	1	0	4	3
MEC102	Introduction to Engineering Design	2	0	0	2
TOTAL	**Group I**(Technical Communication, Physics, Electrical, Civil, Mechanics & Design)	**18**	**2**	**10**	**25**
	Group II (Biology, Chemistry, Electronics, Mechanical & Graphics)	**15**	**1**	**14**	**23**

II Semester

Course Code	Course Name	No of Contact Hours / Week			Credits
		L	T	P	
ENG101/ BIT101R01	Technical Communication	1	0	2	2
	Biology for Engineers	2	0	0	
MAT102	Engineering Mathematics – II	3	1	0	4
CSE201	Object Oriented Programming in C++	3	0	2	4
PHY101 R01/ CHE101	Engineering Physics /	3	0	2	4
	Engineering Chemistry	3	0	2	4
EEE101 / EIE101	Basic Electrical Engineering /	2	0	2	3
	Basic Electronics Engineering	2	0	2	3
CIV101/ MEC101	Basic Civil Engineering /	2	0	2	3
	Basic Mechanical Engineering	2	0	2	3
CIV102 / CIV103	Engineering Mechanics /	2	1	0	3
	Engineering Graphics	1	0	4	3
MEC102	Introduction to Engineering Design	2	0	0	2
TOTAL	**Group I** (Biology, Chemistry, Electronics, Mechanical, &Graphics)	**15**	**1**	**14**	**23**
	Group II (Technical Communication, Physics, Electrical, Civil, Mechanics & Design)	**18**	**2**	**10**	**25**

L	T	P	C
1	0	2	2

Course Code: ENG101R01
Semester: I / II

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.

TEXT BOOK

Houp W, Kenneth et al. Reporting Technical Information. New York: Oxford. 2009.

REFERENCES

1. Markel, Mike. Technical Communication. New York: Bedford. 2007.
2. Laplante, A. Philip. Technical Writing: A Practical Guide for Engineers, Scientists, and Nontechnical Professionals. CRC Press. 2019.
3. Gerson, Sharon & Steven Gerson. Technical Communication: Process and Product. Pearson. 2019.
4. Barrass, Robert. *Scientists Must Write*. London: Routledge.2003
5. Faculty of English. *Technical Communication*. SASTRA Publication. 2017.
6. Ingre, David & Robert Basis. Engineering Communication: A Practice Guide to Workplace Communications for Engineers. Cengage. 2017.
7. Bailey, Stephen. Academic Writing: A Handbook for Students. Routledge. 2018.

ONLINE RESOURCES

1. Strunk, W., Jr. and White, E.B. *Elements of Style*. http://faculty.washington.edu/heagerty/Courses/b572/public/StrunkWhite.pdf
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:

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

L	T	P	C
2	0	0	2

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:

1. Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece. 2016. Campbell Biology (11th edition), Pearson

2. Bar-Cohen, Y. 2012. Biomimetics: Nature-Based Innovation.: CRC Press, Taylor & Francis.

References:

1. Karp, G. 2007. Cell and Molecular Biology, 5th ed. John Wiley and Sons, Inc.
2. Shier D, N., Butler J.L., Lewis R. 2010. Hole's Human Anatomy and Physiology,12thed. New York, N.Y.: McGraw-Hill.

Learning Outcomes

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

L	T	P	C
3	1	0	4

Course Code: MAT101
Semester: I

ENGINEERING MATHEMATICS I

Course Objectives:

1. This course deals with techniques of Trigonometric ratios and transformation of Algebraic equations
2. It provides insight into concepts of limit, continuity and Calculus with applications to Leibnitz theorem. Further it extends methods of finding curvature, evolutes, etc.
3. It imparts techniques in measuring the extreme values of a given function of several variables
4. It describes the evaluation of improper and multiple integrals with simple applications

UNIT – I **15 Periods**

Trigonometry: Expansions of sinnθ and cosnθ in powers of sinθ and cosθ – Expansions of $\sin^n\theta$ and $\cos^n\theta$ in terms of sine and cosine multiples of θ. Hyperbolic and Inverse hyperbolic functions –Logarithm of complex numbers – separation of complex functions into real and imaginary parts – simple problems.
Theory of Equations: Relations between the roots and coefficients – Decreasing and increasing the roots. Formation of equations. Reciprocal equations – Descartes' rule of Signs

Simple problems on stability analysis based on the roots of a polynomial equation.

UNIT – II **15 Periods**

Differential Calculus: Limit, Continuity, Differentiation - Successive differentiation – Leibnitz theorem – Tangent and normal - Simple problems.
Curvature – Radius of Curvature (Cartesian, Polar, Parametric and Implicit form) – Evolutes – Involutes – Envelops (one parameter and two parameters)

UNIT – III **15 Periods**

Functions of Several Variables*:* Partial derivatives, Total derivatives, Jacobians, Taylor Series, Extreme values and Saddle points, Lagrange's method of undetermined multipliers.
Extreme values of temperature functions on the Sphere, Constrained optimization of areas and volumes using Lagrange multipliers, Extreme distances between curves.

UNIT – IV **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 with proofs – 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 – Simple problems

TEXTBOOKS

1. Engineering Mathematics , T.VEERARAJAN et al, Revised Edition 2018, McGraw Hill Education (India) Private Limited
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley and Sons, 12th Edition, 2016

REFERENCES

1. Engineering Mathematics I, M.K. Venkatraman, National Publishing Company, 2002.
2. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2015
3. John Bird, Higher Engineering Mathematics, Sixth Edition, Newnes publications, 2015
4. Control Systems, A. Nagoor Kani, Second Edition, RBA Publications, 2009.

ONLINE MATERIALS

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=122101003
2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=122104017

LEARNING OUTCOMES

The Learner will be able to

Unit I	Interpret trigonometric and hyperbolic functions in terms of complex functions and will be able to solve algebraic equations of higher degree and their transformed equations
Unit II	Determine the Envelops and Evolutes, which emerge in Engineering drawing
Unit III	Obtain extreme values of a given function which helps in finding the optimal value of the function
Unit IV	Evaluate improper integral through special functions and also solve the multiple integral problems and enumerate their applications.

L	T	P	C
3	0	2	4

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
1. Byron, Gottfried. *Programming with C.* 3rd Edition, McGraw Hill Education, 2017.
2. Dromey, R.G. *How to solve it by computer.* Pearson Education Inc., 2012 (Chapters 1–4).

REFERENCES
1. Pradip Dey. and Manas Ghosh. *Computer fundamentals and programming in C*. 2nd Edition, Oxford University Press, 2013.
2. Anil Bikas Chaudhuri. *The art of programming through flowcharts & algorithms.* 1st Edition, Firewall Media, 2018.
3. Brian W Kernighan. and Dennis M Ritchie. *The C programming language*. 2nd Edition, Pearson Education, 2017.

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

Unit I	▪ Write simple algorithms for arithmetic and logical problems
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

L	T	P	C
3	0	2	4

Subject code: PHY101R01
Semester: I / II

ENGINEERING PHYSICS

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 **11 periods**

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 **11 periods**

Introduction to Laser: Spontaneous and Stimulated Emissions - Einstein's A and B Coefficients – Basic Principles of LASER – Population Inversion – Two, Three and Four Level Systems – Different Types of Pumping – Characteristics of LASER. Types of Laser: Nd-YAG LASER– CO_2 Laser – Semiconductor Laser - Applications of Laser

Fiber Optics: Structure and Principles of Optical Fiber – Acceptance Angle and Numerical Aperture – V-Number - Types of Fibers: Step Index, Graded Index, Single Mode & Multimode - Application of Optical Fibers

UNIT - III **12 periods**

Dielectric materials: Properties of Dielectric Materials – Dielectric Constant, Induced and Permanent Dipoles, Polar and Non-Polar Dielectrics, Polarization of Dielectric Materials, Types of Polarization- Electronic Polarizability Derivation- Local Field Derivation- Clausius- Mossotti Equation- Ferro and Piezo-Electricity (Qualitative), Frequency Dependence of Dielectric Constant, Applications of Dielectric Materials.

Magnetic materials: Basics of Magnetic Materials – Classification of Magnetic Materials and Properties – Weiss Theory of Ferromagnetism –Domain Concepts– Hard and Soft Magnetic Materials and its Applications.

Unit – IV **11 periods**

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:

1. M. N. Avadhanulu and P. G. Kshirsagar, “A Text Book of Engineering Physics”, S. Chand and Company, New Delhi (2009).
2. V. Rajendran, “Engineering Physics”, McGraw Hill Education, 1st Edition (2017)

REFERENCE BOOKS:

1. Charles Kittel, “Introduction to Solid State Physics”, Wiley Publications, 8th Edition (2012).
2. Arthur Beiser, “Concepts of Modern Physics”, McGraw Hill Publications, 7th Edition (2015).
3. K. Thiyagarajan and Ajay Ghatak, “Laser Fundamentals and Applications”, Springer Publications, 2nd Edition (2010).
4. G. P Agarwal, “Fiber Optic Communication System”, Wiley Publications, 3rd Edition (2007).

NPTEL Links:

1. Quantum Physics: https://nptel.ac.in/courses/122106034/
2. Lasers: https://nptel.ac.in/courses/115101008/5
3. Fiber Optics: https://nptel.ac.in/courses/115107095/
4. Dielectrics: https://nptel.ac.in/courses/115101005/downloads/lectures-doc/Lecture-20.pdf
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:

Unit I	Distinguish the classical limits and existence of quantum nature of particles.
Unit II	Classify the different types of lasers, optical fibers including their applications.
Unit III	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.
Unit IV	Recognize intrinsic, extrinsic, elemental and compound semiconductors.

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
3. Spectrometer Grating- Measurement of Wavelengths of Hg Spectrum.
4. Fiber Optics- Measurement of Acceptance angle and Numerical Aperture.
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.
13. Thermistor – Determination of Energy gap.
14. B-H curve – Measurement of Hysteresis loss, Retentivity and Coercivity of a toroid.
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

L	T	P	C
3	0	2	4

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
Definition of hard and soft water, Sources of water and classification of impurities, Hardness and its types, Units of hardness, Determination of hardness of water by EDTA method. Boiler problems – Scale and Sludge formation in boiler, Priming & Foaming, Caustic Embrittlement. Internal treatment methods. Water softening processes –Zeolite process, Ion-exchange process. Brackish water treatment-Electrodialysis, Reverse osmosis. BOD, COD-definition and significance. Sterilization - ozonolysis, UV, chlorination, Specifications (Indian standards) for: Drinking water, Boiler feed water, Water used in electronic and construction industries.

UNIT – II **11 Periods**

REDOX REACTIONS AND ELECTROCHEMISTRY
Electrochemistry - Single electrode potential, Nernst equation, Electrochemical series and its applications. Electrolysis of water. Electrodeposition, Electroless deposition, Plating on plastics.
Energy devices -Primary battery (Alkaline battery), Secondary battery (Lead-Acid, Ni-Cd and Li-ion). Supercapacitor- Principle. Fuel cells – Principle and advantages, Hydrogen-Oxygen Fuel cells, Proton exchange membrane fuel cell, Alkaline fuel cell, Solid oxide fuel cell.

Corrosion and its control - Chemical and electrochemical corrosion, Microbial induced concrete corrosion and biofouling. Corrosion control - Design, Anodic and cathodic protection. Surface Coatings - Inorganic coatings (Galvanization, Tinning, Electrode position, Anodization) and Organic coatings - oil paints. Inhibitors (cathodic and anodic).

UNIT –III **12 Periods**
ASSOCIATIVE INTERACTIONS AND LUBRICANTS
Intermolecular interactions– ionic interactions, ion-dipole interactions, hydrogen bonding, dipole-dipole interactions, London dispersion forces. Relative strength of intermolecular forces - H_2O-H_2S, HCl-HF, Ethanol-diethyl ether, Polyethylene-Teflon. Consequences - surface tension.

Lubricants- Mechanisms of lubrication - Fluid film, Boundary film & Extreme pressure. Types of lubricants – Solid lubricants – Molybdenum disulphide, Graphite. Liquid lubricants –

Vegetable, Animal, Mineral & Synthetic oils. Semi solid lubricants – Greases, Lubricating Emulsions – Oil in water, Water in oil.
Properties of lubricants and its significance – Physical properties – Viscosity & Viscosity Index. Determination of viscosity by Redwood viscometer, Flash & Fire point by Pensky-Marten's apparatus, Cloud & Pour point.
Lubricating oils – Acid value, Saponification value, Steam emulsification number.

UNIT – IV **11 Periods**

ADVANCED MATERIALS

Composites –Introduction, Constitution-Matrix phase, Dispersed phase. Characteristic properties of composite materials. Classification- (A) Particle - reinforced composites- i) Large – particle reinforced composites ii) Dispersion – strengthened composites. (B) Fiber – reinforced composites- i) Continuous – aligned ii) Discontinuous – aligned (short)- (a) aligned (b) randomly oriented (C) Structural Composites- i) Laminates (ii) Sandwich Panels.

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

Gopalan, R, D.Venkappayya and Sulochana Nagarajan, *A Textbook of Engineering Chemistry*. Vikas Publishing House, New Delhi, 4th edition, 2013.

REFERENCES

1. Jain, P.C. and Monika Jain. *Engineering Chemistry*. Dhanpat Rai Publications, New Delhi, 16th edition, 2015.
2. Palanna, O. G. *Engineering Chemistry*. McGraw Hill Publishing Company, Chennai, 2nd edition, 2009.
3. Kuriacose, J. C. and J. Rajaraman. *Chemistry in Engineering & Technology*. Vol I & II. Tata McGraw Hill Publishing Company, New Delhi, 2001.
4. Rao, C. N. R., A. Muller, A.K. Cheetam.*The Chemistry of Nanomaterials: Synthesis, Properties and Applications*. Wiley-VCH Verlag GmbH, 2004.

LEARNING OUTCOMES

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

Unit –I	Select and employ suitable water treatment technologies for domestic and industrial applications
Unit –II	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
Unit –III	Identify the various intermolecular interactions existing in the given system Demonstrate an understanding of lubricants, their properties and industrial applications
Unit –IV	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

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:

Expt. 1	Measure the quantitative capacity required to neutralize the water and quantify oxidizable chemical impurities present in waste water
Expt.2	Evaluate the quality of bleaching powder by iodometric titration
Expt.3	Employ complexometric titrations to quantify anthropogenic metals or estimate total hardness of a water sample
Expt.4	Measure the single electrode potential of a particular electrode Construct an electrochemical cell and demonstrate its utility
Expt.5	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

Expt.6	Estimate the strength of given acid or base using conductance measurements
Expt.7	Demonstrate the interaction between adsorbate and adsorbent and estimate the amount of given acid adsorbed by the charcoal
Expt.8	Estimate two important properties of oils and select appropriate oil for edible or lubrication applications
Expt.9	Demonstrate the influence of additives on the change in the physical properties of polymer composites
Expt.10	Synthesize metal nanoparticles by simple wet chemical method and demonstrate the influence of capping agents on their stability
Expt.11	Employ a technology to apply thin coherent metal coating on a metal surface using the principle of electrolysis
Expt.12	Produce a value-added product from readily available precursors using saponification reaction

L	T	P	C
2	0	2	3

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 in to the electric power supply systems and various types of electrical loads

UNIT – I **9 Periods**

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 **7 Periods**

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 **7 Periods**

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 **7 Periods**

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

1. Edward Hughes. *Electrical and Electronics Technology*: Pearson Education, 12th Edition, 2016.
2. Muthusubramanian, R. and S. Salivahanan. *Basic Electrical and Electronics Engineering*: Tata Mc Graw Hill Education Pvt. Ltd., 2010.
3. Mittle, V.N. and Arvind Mittal. *Basic Electrical Engineering:* Tata Mc Graw Hill Education Pvt. Ltd., 2nd Edition, 2005.

REFERENCE

Theraja, B.L. and A.K. Theraja. *A text book of Electrical Technology*: S. Chand Publishers, 24rd Edition, 2014.

ONLINE MATERIALS

1. NPTEL –http://nptel.ac.in/courses/108108076/1
2. MIT Courseware – https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-011/

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:

Unit I	Apply Ohm's law and Kirchhoff's laws for solving series and parallel circuits and analyze a circuit using mesh and nodal methods Analyze steady state behaviour of AC circuits with R, R-L, R-C, and R-L-C circuits
Unit II	Understand the generation of dynamically induced EMF in a DC generator and explain the construction and operation of DC machines
Unit III	Understand the generation of statically induced EMF in a transformer and explain the construction and operation of transformers
Unit IV	Demonstrate simple domestic wiring, summarise general safety requirements as per IE rules, understand electric power system and classify various types of loads

L	T	P	C
2	0	2	3

Course Code: EIE101
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 **8 Periods**

Semiconductor Diode

P–N junction: Structure, operations and V-I characteristics - Diode applications: Clipping, clamping, Voltage-Multiplier circuits and rectification–Zener Diode: V-I characteristics, Zener diode as a Voltage regulator - Logic gates using diodes

Opto Electronic Devices

Light–Emitting Diodes, Photo diodes and Liquid-Crystal Display (LCD)

UNIT – II **8 Periods**

Bipolar Junction Transistor

Transistor Construction - Operation of PNP and NPN transistor – Input and output characteristics: Common Base, Common Emitter and Common Collector Configuration – Transistor as an amplifier and a switch

Field Effect Transistor

Construction and theory of operation of JFET – Drain and transfer characteristics of JFET – MOSFET operation in Depletion and Enhancement mode-MOSFET as a switch –CMOS as an inverter

UNIT – III **7 Periods**

Operational Amplifiers

Dual input Differential Amplifier using transistor – CMMR, Ideal Characteristics, Virtual ground. Applications of Op-Amp: Inverting, Non-inverting and differential Amplifier, Mathematical operations: Summing amplifier, difference amplifier, differentiator and integrator –Op-Amp as an open-loop comparator

UNIT – IV **7 Periods**

Power Supply

Basic building blocks of regulated power supply, Series and shunt voltage regulator using Transistor

Electronic Measuring Instruments

PMMC-Basic DC voltmeter and DC ammeter

Oscilloscope

Basic block diagram of oscilloscope – Measurement of voltage, current, phase and frequency using CRO

TEXTBOOKS

1. Edward Hughes, Electrical and Electronic Technology, 10th Edition, Pearson, 2004
2. Ralph J.Smith & Richard C.Dorf, Circuits, Devices and System, 5th Edition, Wiley, 2004
3. S. K.Bhattacharya, Basic Electronics Engineering, 1st Edition, Pearson, 2017
4. Mehta, V.K. & Rohith Mehta. Principles of Electronics. 3rd Edition, S Chand and Company. 2005.
5. Adel S.Sedra, Kenneth C. Smith, Microelectronic Circuits, 6th Edition, Oxford university Press. 2013.
6. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits; 4th Edition, McGraw Hill, 2014.
7. Albert D. Helfrick, William D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Pearson, 1st Edition, 2016

REFERENCES

1. V.Jegathesan, K.Vinothkumar & R.Saravanakumar, Basic Electrical and Electronics Engineering, 1st Edition, Wiley- India. 2011.
2. Roy Choudhury, D. & Jain, Shail, B. Linear Integrated Circuits. 4th Edition, New Age International publishers. 2010.
3. Kalsi, H. S. Electronic Instrumentation. Tata McGraw – Hill, 3rd Edition. 2010

LEARNING OUTCOMES

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

Unit I	▪ Explain the working principle of various semiconductor devices ▪ Apply the concept of diodes for different applications
Unit II	▪ Explain the working of BJT, JFET and MOSFET ▪ Understand the characteristics of BJT and JFET
Unit III	▪ Design different circuits using Op-Amp under inverting, non-inverting and differential mode ▪ Design the Op-Amp for different mathematical operations
Unit IV	▪ Design series and shunt voltage regulator using transistor ▪ Design regulated dc power supply ▪ Measure voltage, frequency and phase using CRO

List of Experiments

1. V-I Characteristics of p-n junction diode and zener diode
2. Applications of diode: Half wave rectifier and Full wave rectifier, Clipper and Clamper
3. Input and output characteristics of Common Emitter amplifier
4. Drain and transfer characteristics of JFET and JFET as a switch
5. Inverting, non-inverting and differential amplifier using Op-Amp
6. Summer, subtractor, integrator and differentiator using Op-Amp
7. Design of series and voltage regulator using transistor
8. Measurement of voltage, current, frequency and phase using CRO

COURSE LEARNING OUTCOMES

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

- explain the characteristics of various devices and use them for different applications
- design analog circuits using Op-Amp for different applications
- design series and shunt voltage regulator using transistor
- design a regulated power supply unit
- measure the various electrical parameters using CRO

Course Code: CIV 101
Semester: I / II

L	T	P	C
2	0	2	3

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 **8 Periods**

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 **9 Periods**

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 **6 Periods**

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 **7 Periods**

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

1. M.S. Palanichamy and C. Shanmugham. *Basic Civil Engineering and Basic Mechanical Engineering.* Tata McGraw–Hill Publishing Company Ltd., 2000.

REFERENCES

1. B. C. Punmia, Ashok K. Jain and Arun K. Jain. *Basic Civil Engineering*. Laxmi Publications Pvt. Ltd., 2017.
2. Satheesh Gopi. *Basic Civil Engineering*. Pearson Publications, 2010.

ONLINE MATERIALS

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

LEARNING OUTCOMES

Unit I	Student will be able to • Explain the planning regulations and by-laws. • Classify civil engineering materials based on their properties and uses.
Unit II	Student will be able to • Identify the loads acting on a structure. • Explain the functions of the sub-structure and super-structure elements of a building. • Classify the roads and explain the functions of flexible and rigid pavements.
Unit III	Student will be able to • Explain the fundamental principles of surveying • Measure length, orientation, rise/fall using chain, compass, dumpy level, total station and their allied instruments. • Compute area of a land and calculate reduced levels of different stations on the land.
Unit IV	Student will be able to • Explain the fundamental principles of watershed management and rain water harvesting. • Classify dams and explain their functions. • Explain the principle and methods of irrigation.

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

L	T	P	C
2	0	2	3

Course Code: MEC101
Semester: I / II

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.

Forming – Principles of Forging – Rolling – Extrusion – Sheet Metal Forming (Blanking, Punching & Bending) – Wire Drawing.

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).
Welding – Principles – Types (Manual Metal Arc Welding and Oxy-Acetylene Gas Welding).

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).

I.C. Engines – Types – Working Principles of 2-Stroke (Petrol Engine) and 4-Stroke Engines (Petrol and Diesel Engine) – Fuel Injection Systems (Fuel Injection Pump and Injector for Diesel Engine & MPFI for Petrol Engine) – Ignition Systems (Battery and Magneto Ignition) – Cooling and Lubrication 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:

Theory	
Unit I	Apply the different aspects of manufacturing technology in machining and forming areas
Unit II	Explain the primary operations of casting and metal joining processes
Unit III	Explain the basic principles applied in refrigeration and air conditioning systems and identify the components & systems of IC Engine
Unit IV	Discuss the various forms of energy sources available, its application for power generation, energy conservation and the components of various types of power plant
Practical	
▪ Identify different tools, select and apply suitable machining processes ▪ Demonstrate the working of IC engine and transmission system ▪ Explain CNC machining and additive manufacturing technology	

TEXTBOOK

1. K. Venugopal and V. Prabu Raja, Basic Mechanical Engineering, Anuradha Publications, 2007

REFERENCES

1. T. J. Prabhu, V. Jaiganesh and S. Jebaraj, Basic Mechanical Engineering, SCITECH Publications Ltd., 2001.
2. R.K. Rajput, Thermal Engineering, Lakshmi Publishers, 2010.
3. S.K.Hajra Choudry. Elements of workshop Technology Vol I&II, Asia Publishing House.

ONLINE MATERIALS

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=112107144
2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=112108148
3. http://nptel.ac.in/syllabus/syllabus.php?subjectId=112104113

L	T	P	C
2	1	0	3

Course Code: CIV 102
Semester: I / II

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

Equations of motion – applications; Relationships between distance, velocity, acceleration and time. Introduction to curvilinear motion, projectile motion.

Applications of D'Alembert's principle, work-energy principle, impulse and momentum – conservation of linear momentum.

TEXTBOOK

1. Basudeb Bhattacharyya, Engineering Mechanics, Second Edition, OUP,2014

REFERENCES

1. N H Dubey, Engineering Mechanics, McGraw Hill Education, 2016.
2. S Rajasekaran, G Sankarasubramanian, Fundamentals of Engineering Mechanics, Third Edition,Vikas Publishing house Pvt. Ltd. Reprint 2011.
3. Beer F.P and Johnston.E.R, Vector Mechanics for Engineers – Statics and Dynamics, McGraw Hill International Book Company, 2002.
4. Ferdinand L.Singer, Engineering Mechanics (Statics and Dynamics), Harper Row Publishers.2007.
5. Meriam.J.L and Kraige.L.G, Engineering Mechanics (Statics and Dynamics), John Wiley and Sons.2001.
6. Shames.I.H, Engineering Mechanics (Statics and Dynamics), Prentice Hall of India, New Delhi, 2004.
7. Timoshenko.S.P and Young.D.H, Engineering Mechanics, McGraw Hill Book Co. Ltd.2003.

ONLINE MATERIALS

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=122104014
2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=122104015

LEARNING OUTCOMES

Unit I	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).
Unit II	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.
Unit III	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).
Unit IV	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.

L	T	P	C
1	0	4	3

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 **10 Periods**

Introduction to Engineering drawing & Drafting Software.
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, Involutes – square and circle .

UNIT – II **10 Periods**

Orthographic projection
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 **10 Periods**

Section, Intersection and Development of Surfaces of solids
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 **15 Periods**

Isometric projection
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.

TEXTBOOKS

1. Venugopal, K. and V. Prabhu Raja. *Engineering Drawing.* New Age International (P) Limited, 2010
2. Narayana, K. L. and P. Kannaiah. *Textbook on Engineering Drawing.* Scitech Publications, 2010.

REFERENCES

1. Gopalakrishna, K. R. *Engineering Drawing.* Subas Publications,2010.
2. Bhatt, N. D. and V. M. Panchal. *Engineering Drawing.* Charotar Publishing house, 2012.
3. Natarajan, K. V. *A text book of Engineering Drawing Graphics.* Dhanalakshmi Publishers, Chennai, 2008.
4. Dhananjay AJolhe. *Engineering Graphics* McGraw-Hill Publishing Company, Ltd, 2009.

ONLINE MATERIALS

1. NPTEL- http:// nptel.ac.in/courses/112104031/1
2. NPTEL- http:// nptel.ac.in/courses/112103019/
3. http://nptel.ac.in/syllabus/syllabus.php?subjectId=107103002

LEARNING OUTCOMES

Unit I	The learner will be able to draw plane and special curves which are of great importance to engineers using Auto CAD software.
Unit II	The learner will be able to draw the projection of solids in the first quadrant.
Unit III	The learner will be able to draw sectional views, intersection of surfaces of solids and development of lateral surfaces of solids.
Unit IV	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.

L	T	P	C
2	0	0	2

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 **7 Periods**

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

UNIT – II **8 Periods**

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

Quality Function Deployment (QFD) method – House of Quality – Kano model for customer satisfaction.

UNIT – III **8 Periods**

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

UNIT – IV **7 Periods**

Concepts evaluation and selection
Decision matrix; applying metrics to objectives towards selection of preferred concepts.

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

TEXTBOOKS

1. Engineering Design – a project based introduction, Clive L. Dym, Patrick Little and Elizabeth J Orwin, Wiley India edition, 2016.
2. Engineering design process, Yousef Haik and Tamer Shahin, Cengage Learning, 2011.

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.

L	T	P	C
3	1	0	4

Course Code: MAT102
Semester: II

ENGINEERING MATHEMATICS II

Course Objectives:

1. This course provides various Mathematical Techniques to solve Ordinary Differential Equations
2. It renders the method of finding eigen values and eigenvectors for a given matrix. Further it describes the transformation of quadratic form to canonical form through orthogonal transformation
3. It elucidates the concept of Vector Differentiation and vector identities
4. It deals with vector integration resulting vector integral theorems, which are useful in finding areas and volumes

UNIT – I **15 Periods**

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.

Law of growth – Steady state Heat flow - orthogonal trajectories - L-C-R circuit problems – bending of beams - simple problems

UNIT – II **15 Periods**

Matrix Algebra: Inverse of a matrix by elementary transformation –Linear independence of vectors – Eigen values and Eigen vectors – properties of Eigen values and Eigen vectors with proofs – Higher powers and Inverse of the matrix by Cayley Hamilton theorem – Similarity transformation – Orthogonal transformation of a real symmetric matrix – Quadratic Forms – Nature of Quadratic forms – Canonical form.

Reduction of a matrix polynomial, Diagonalisation of a matrix through transformations, Reduction of Quadratic form to Canonical form, Nodal analysis and Mesh analysis of Electrical Circuits - System of n spring coupled masses.

UNIT – III **15 Periods**

Vector Differentiation: Vector differential operator: Gradient, Divergent and Curl operators - Directional derivative - Scalar potential of a vector function - Irrotational and Solenoidal vector fields – Vector operator identities - proofs -Simple Problems.

Electrical flux, Magnetic flux – Conservative forces – Simple problems.

UNIT – IV **15 Periods**

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

TEXTBOOKS

1. Engineering Mathematics, T.VEERARAJAN et al, Revised Edition 2018, McGraw Hill Education (India) Private Limited
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley and Sons, 12th Edition, 2016.

REFERENCES

1. Engineering Mathematics Volume II, M.K.Venkataraman, National publishing Company, 2014
2. Engineering Mathematics Volume III, P. Kandasamy and others, S. Chand, 2016.
3. Advanced Calculus , Volume I, S. Arumugam, A.Thangapandi Issac, New Gamma Publishing House,2015
4. Engineering Mathematics II , Vijay Nicole imprints private limited (Revised Edition 2015)

ONLINE MATERIALS

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=122104018
2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=122103012

LEARNING OUTCOMES

The Learner will be able to

Unit I	Solve differential equations that arise from Science / Engineering domains
Unit II	Represent data in matrix form for various matrix operations and proficient in handling various linear algebraic techniques.
Unit III	Evaluate derivatives over vector fields henceforth identifies the nature of the vector field.
Unit IV	Evaluate integrals over vector fields which helps in finding work done, potential function etc.

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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 **11 Periods**

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 **11 Periods**

Objects and Classes
Implementation of classes in C++, C++ objects as physical objects, C++ objects as data types, constructors, 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 **11 Periods**

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 **12 Periods**

Pointers
Addresses and pointer, address-of operator &, pointer and arrays, pointer and fraction, pointer and C- type string

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
1. Robert Lafore. *Object oriented programming in C++.* 4th Edition, Pearson Education, 2012.

REFERENCES
1. Behrouz A Forouzan, and Richard F Gilberg. *Computer Science: A Structured Approach using C++.* 2nd Edition, Cengage Learning, 2014.
2. Joyce Farrell. *Object Oriented Programming using C++.* 4th Edition, Cengage Learning, 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

Unit I	▪ Describe the object oriented concepts
Unit II	▪ Employ the concepts of classes and objects for a given application
Unit III	▪ Create user defined data types with overloaded operators ▪ Develop applications by making use of inheritance
Unit IV	▪ Employ pointers for better memory management ▪ Develop applications using file streams

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