Maratha Vidya Prasarak Samaj's

Karmaveer Adv. Baburao Ganpatrao Thakare College of Engineering

An Autonomous Institute affiliated to Savitribai Phule Pune University, Pune

Udoji Maratha Boarding Campus, Gangapur Road, Nashik - 422 013, Maharashtra, India

Syllabus

First Year B. Tech. (2024 Pattern)

(As per NEP 2020 - Common to All UG Engineering Programs)

Academic Year 2024-25

(Copy for Student Circulation Only)

First Year B. Tech. Curriculum Structure (2024 Pattern) Semester - I

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks						Credits			
			TH	PR	TU	CCE	ESE	TW	PR	OR	TOT	TH	PR	TU	TOT
100101	BSC	Engineering Mathematics-I	3	-	1	40	60	25	-	-	**125**	3	-	1	**4**
100102/ 100202	BSC	Engineering Physics / Engineering Chemistry	3	2	-	40	60	25	-	-	**125**	3	1	-	**4**
100103/ 100203	ESC	Fundamentals of Electronics Engineering / Basic Electrical Engineering	2	2	-	40	60	25	-	-	**125**	2	1	-	**3**
100104/ 100204	ESC	Engineering Graphics / Engineering Mechanics	2	2	-	40	60	25	-	-	**125**	2	1	-	**3**
100105	ESC	Fundamentals of Programming	2	2	-	40	60	25	-	-	**125**	2	1	-	**3**
100106/ 100206	VSEC	Workshop Practice / Design Thinking and Idea Lab	-	2	-	-	-	25	-	-	**25**	-	1	-	**1**
100107	AEC	Professional Communication Skills	-	-	2	-	-	25	-	-	**25**	-	-	2	**2**
100108	CC	Co-Curricular Course-I	-	4	-	-	-	25	-	-	**25**	-	2	-	**2**
Total			**12**	**14**	**3**	**200**	**300**	**200**	**-**	**-**	**700**	**12**	**7**	**3**	**22**

Abbreviations: **TH:** Theory **PR:** Practical **TU:** Tutorial **CCE:** Continuous Concrete Evaluation
ESE: End-Semester Examination **TW:** Term Work **OR:** Oral **TOT:** Total

First Year B. Tech. Curriculum Structure (2024 Pattern) Semester - II

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks						Credits			
			TH	PR	TU	CCE	ESE	TW	PR	OR	TOT	TH	PR	TU	TOT
100201	BSC	Engineering Mathematics-II	3	-	1	40	60	25	-	-	**125**	3	-	1	**4**
100102/ 100202	BSC	Engineering Physics / Engineering Chemistry	3	2	-	40	60	25	-	-	**125**	3	1	-	**4**
100103/ 100203	ESC	Fundamentals of Electronics Engineering / Basic Electrical Engineering	2	2	-	40	60	25	-	-	**125**	2	1	-	**3**
100104/ 100204	ESC	Engineering Graphics / Engineering Mechanics	2	2	-	40	60	25	-	-	**125**	2	1	-	**3**
100205	PCC	Programming and Problem Solving	2	2	-	40	60	25	-	-	**125**	2	1	-	**3**
100106/ 100206	VSEC	Workshop Practice / Design Thinking and Idea Lab	-	2	-	-	-	25	-	-	**25**	-	1	-	**1**
100207	IKS	Indian Knowledge System	-	-	2	-	-	25	-	-	**25**	-	-	2	**2**
100208	CC	Co-Curricular Course-II	-	4	-	-	-	25	-	-	**25**	-	2	-	**2**
Total			**12**	**14**	**3**	**200**	**300**	**200**	**-**	**-**	**700**	**12**	**7**	**3**	**22**

Abbreviations: **TH:** Theory **PR:** Practical **TU:** Tutorial **CCE:** Continuous Concrete Evaluation
ESE: End-Semester Examination **TW:** Term Work **OR:** Oral **TOT:** Total

- **Summary of Credits and Total Marks:**

Semester	Credits	Marks
I	22	700
II	22	700
Total	**44**	**1400**

• Definition of Credit :

The Under Graduate (U.G.) programmes will have credit system. The details of credit will be as follow.
1 Credit = 1 hour/week for lecture
= 2 hours/week for practical
= 1 hour/week for tutorial

- **Description of various Courses:**

Type of Course	Description
BSC	Basic Science Course
ESC	Engineering Science Course
PCC	Programme Core Course
VSEC	Vocational and Skill Enhancement Course (Skill Courses)
AEC	Ability Enhancement Course
CC	Co-curricular Courses (CC) / Liberal Learning Courses

Note: The Induction Program for First-year students will be conducted for two weeks in the semester - I and One week in the semester – II before commencement of teaching as per AICTE guidelines.

Semester - I

Course Code:100101		Course Name: Engineering Mathematics-I	
Teaching Scheme		**Credit**	**Evaluation Scheme**
Theory : 3 Hours/Week **Tutorial :** 1 Hour/Week		**3** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Basic Concepts of Mathematics covered Intermediate: Matrices, Determinants Differentiation, Maxima and Minima.

Course Objectives:

- To introduce students to fundamental concepts and techniques in calculus, linear algebra.
- By mastering these areas, students will gain the analytical tools necessary for understanding advance mathematics and its application, ultimately enhancing their problem solving abilities and critical thinking skills within their respective fields.

Course Outcomes:

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

CO1: Apply tools from linear algebra to solve system of linear equations.

CO2: Determine eigen values & eigen vectors. Use them to diagonalize matrices and reduce quadratic form to their canonical form.

CO3: Apply knowledge of linear algebra to solve simple real life problems.

CO4: Evaluate derivative functions of several variables which are essential for solving various engineering problems.

CO5: Apply partial derivatives in estimating errors and finding extreme values of the function**.**

Course Content:

Unit-I: Linear Algebra- Matrices and System of Linear Equations 08 Hours

Rank of Matrix, Normal form, Echelon form, System of linear equations: Homogeneous and non-homogeneous system, Linear dependence & Independence, Orthogonal & Linear Transformation.

Unit-II: Linear Algebra- Eigen Values, Eigen Vectors 09 Hours

Eigen Values and Eigen Vectors, Properties of Eigen Values and Eigen Vectors, Cayley Hamilton theorem, Diagonalization of a matrix, Nature of Quadratic Form, Reduction of Quadratic forms to Canonical form by Linear Transformation.

Unit-III: Application of Linear Algebra 07 Hours

Introduction to modular arithmetic, Euclid's Algorithm, Encrypt & Decrypt the statement using matrix, Application of system of linear equation in electric circuit, traffic problem.

Unit-IV: Partial Differentiation 08 Hours

Introduction to functions of several variables, Partial Derivatives of first order and higher order derivative, Total differentiation of composite and implicit function, Euler's Theorem on homogenous function.

Unit-V: Application of Partial Differentiation 08 Hours

Jacobians, Functional dependence, Errors and Approximations, Maxima and Minima of functions of two independent variables, Lagrange's method of undetermined multipliers.

Learning Resources:

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson)
5. Applied Mathematics (Vol. I & Vol. II) by P.N.Wartikar and P.N.Wartikar Vidyarthi Griha Prakashan, Pune.

Web link for MOOC / NPTEL Links

1. https://www.youtube.com/playlist?list=PLbRMhDVUMngeVrxtbBzn8HvP8KAWBpI5

Tutorial and Term Work:

1. Tutorial for the subject shall be conducted in minimum three batches (batch size of 23 students maximum) per division.
2. Term work shall be awarded on the basis of performance of students during tutorials as continuous internal assessment.

Course Code: 100102	Course Name: Engineering Physics	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 3 Hours/Week **Practical :** 2 Hours/Week	**3** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Basic concepts of physics covered in Intermediate: Bohr's atomic theory, properties of electromagnetic waves, Huygen's Principle and wave front, interference, diffraction and polarization of light, wave particle duality, intrinsic and extrinsic semiconductors, atomic arrangement.

Course Objectives:

- The objective of the course is to impart the knowledge of fundamentals of physics through hands-on experiments and extend it to relevant engineering applications.

Course Outcomes:

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

CO1: Develop the understanding of the mechanism of lasers, optical fibers and extend it to its engineering applications.

CO2: Develop understanding of Fermi level and Fermi energy in semiconductors and relate them with the working of semiconducting devices. Explain the phenomenon of Superconductivity and estimate its engineering applications.

CO3: Deduce Schrödinger's wave equations and apply it to problems on the bound states by summarizing fundamentals of quantum physics.

CO4: Utilize phenomena of light (interference and Polarization) to Engineering applications in Anti-Reflection Coating, optical flatness and LCD.

CO5: Extend the understanding of Ultrasonic to thickness measurement, flaw detection. Develop understanding of crystal structure and extend it to explain X-ray Diffraction.

Course Contents

Unit-I: Laser and Optical Fiber **08 Hours**

Laser: Stimulated Absorption, Spontaneous and stimulated emission, population inversion, pumping, Metastable states, active medium, resonant cavity; Characteristics of lasers; Types of lasers-solid, liquid & gas lasers; Semiconductor laser (Hetero-junction) - principle, construction and working; Engineering

applications of laser (IT, medical & industry); Holography (recording and reconstruction).

Optical fibers: Total internal reflection, critical angle, acceptance angle, acceptance cone & numerical aperture (derivation); Classification of optical fibers-step index & graded index; Advantages of optical fiber communication; numerical on parameters of optical fiber; Applications of optical fiber.

Unit-II: Semiconductor Physics and Superconductivity 10 Hours

Semiconductor Physics: Valence band, conduction band & band gap energy; Classification of solids on the basis of band theory; Fermi level and Fermi energy for metal and semiconductor; FD distribution function and its temperature dependence; position of Fermi level in intrinsic semiconductor (derivation) & extrinsic semiconductor; working of PN junction diode on the basis of Fermi energy; Solar cell-principle, working, IV-characteristics, efficiency and fill factor, advantages and applications in environmental sustainability; Hall effect-derivation for Hall voltage and Hall coefficient and related numerical problems.

Superconductivity: Properties of Superconductivity-Zero Electrical resistance, critical magnetic field, Persistent current; Meissner effect and perfect diamagnetism; Type I and Type II Superconductors; Numericals on critical magnetic field; DC and AC Josephson effect; Applications of superconductivity-SQUID (working principle and applications).

Unit-III: Quantum Physics 08 Hours

De Broglie hypothesis of matter waves; de Broglie wavelength in terms of K.E. and electric potential (derivation and numerical); properties of matter waves; Wave function and probability density; conditions for well-behaved wave function; Schrödinger's equations-Time independent and time dependent; Energy of a particle enclosed in a rigid box (derivation and numerical); Quantum mechanical tunneling- alpha particle decay, principle and working of STM; Introduction of Quantum Computing, concept of Qubit, superposition, entanglement and measurement.

Unit-IV: Wave Optics 06 Hours

Interference: Interference in thin film of uniform thickness- conditions of maxima and minima for reflected system; Conditions of maxima and minima for wedge shaped film (qualitative); engineering applications – Antireflection coating, testing of optical flatness; Numericals on thin film and wedge-shaped film.

Polarization: Types of Polarization- PPL, CPL and EPL; Malus law and related Numericals; Double refraction-Huygen's theory of double refraction; Engineering applications of polarization-LCD.

Unit-V: Ultrasonics and Crystal Structure 08 Hours

Ultrasonics: Characteristics and properties of ultrasonic waves; Generation of ultrasonic waves by inverse piezoelectric effect (using transistor); Engineering applications - thickness measurement, flaw detection and related Numericals.

Crystal Structure and X-rays: Unit cell, Bravais lattice, cubic system, number of atoms per unit cell, coordination number, atomic radius, packing density; Relation between lattice constant and density; lattice planes and Miller indices; Inter-planar spacing for cubic system; Bragg's law; X-ray diffraction; Applications of XRD (qualitative); discrete & Continuous X-rays; Mosley's law.

Learning Resources:

Text Books:

1. A Textbook of Engineering Physics, M. N. Avadhanulu, P. G. Kshirsagar & TVS Arun Murthy, S. Chand Publications.
2. Engineering Physics, R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications.

Reference Books:

1. Optics, Ajoy Ghatak, Tata Mc Graw Hill
2. Introduction to Solid State Physics, C. Kittel, Wiley and Sons.
3. Quantum Mechanics, A. K. Ghatak, S. Lokanathan, Laxmi Publications.
4. Physics for Scientists and Engineers with Modern Physics, Serway and Jewett, Cengage Publications.

E-Books:

1. Feynman Lecture series: https://www.feynmanlectures.caltech.edu/
2. Concepts of Modern Physics, Arthur Beiser: https://nitsri.ac.in/Department/PHYSICS/Beiser_Modern_Physics.pdf

Web link for MOOC / NPTEL Links

1. Lectures by Walter Lewin: https://www.youtube.com/channel/UCiEHVhv0SBMpP75JbzJShqw
2. Quantum Mechanics Lecture Series by Prof. H. C. Verma: https://www.youtube.com/playlist?list=PLWweJWdB_GuISnGkAafMpzzDBvTHg02At

Laboratory Experiments: (Any 8 Experiments)

1. An experiment based on Laser: To determine the divergence of a laser beam or to determine diameter of a thin wire or to perform beam profile analysis of a laser beam.
2. An experiment based on optical fiber: To determine the numerical aperture or attenuation coefficient or critical angle of optical fiber.
3. Determination of Planck's constant using LED experimental setup.
4. Newton's rings: To understand the interference and determine radius of curvature of a given plano-convex lens or determine wavelength of given monochromatic light.
5. An experiment based on diffraction: Determination of number of lines per centimeter on grating surface using normal incidence method or determination of wavelength of laser using transmission grating or to determine wavelength of light using diffraction grating & spectrometer.
6. An experiment based on polarization: To determine refractive indices of extraordinary and ordinary rays using double refractive prism.
7. To determine the band gap energy of a semiconductor sample using a PN junction diode.
8. To plot I-V characteristics and determine the fill factor of solar cell.
9. Determination of velocity of ultrasonic waves in given liquid by using Ultrasonic Interferometer.
10. Study tour / visit to a research laboratory / facility and submit a report.
11. Virtual lab / conceptual project.

Course Code: 100202	Course Name: Engineering Chemistry	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 3 Hours/Week **Practical :** 2 Hours/Week	**3** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Basic concepts of chemistry covered in Intermediate: Types of titrations, structure property relationship, classification and properties of polymers, electromagnetic radiation, electrochemical series.

Course Objectives:

- To understand technology involved in analysis and improving the quality of water as a commodity.
- To acquire the knowledge of electro-analytical techniques for chemical analysis that facilitates rapid and precise understanding of materials.
- To understand structure, properties and applications of specialty polymers and nano material.
- To study conventional and alternative fuels with respect to their properties and applications.
- To understand corrosion mechanisms and preventive methods for corrosion control.

Course Outcomes:

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

CO1: Apply suitable methods for water analysis and various treatment methods.

CO2: Apply different electro analytical techniques for chemical analysis

CO3: Apply advanced concepts in polymer science, nanomaterial, and green chemistry to solve engineering challenges.

CO4: Classify different kinds of fuels on the basis of calorific value and can define need for alternative energy sources

CO5: Identify the factors that influence the rate of corrosion and Apply Corrosion Control Techniques

Course Contents

Unit-I: Analytical Aspects of Water **08 Hours**

Properties of water, impurities in water and types, hardness of water: Types, Units and numerical. Determination of hardness by EDTA method & numerical. Alkalinity by neutralization titration method and numerical. Ill effects of hard water in boilers – i) Scale and sludge ii) Priming and foaming iii) Boiler corrosion. **Water treatment:** Zeolite method and numerical. Purification of water by Reverse osmosis process.

Unit-II: Instrumental Methods of Analysis 08 Hours

Reference Electrode, Types of reference electrode (calomel electrode), indicator electrode (glass electrode).

Conductometry: Introduction, conductivity cell, conductometric titrations of acid versus base with titration curve. (Strong acid- Strong base). Applications of conductometry.

pH metry: Introduction, standardization of pH meter, pH metric titration of strong acid versus strong base with titration curve and its applications.

UV-Visible Spectroscopy: Introduction, statement of Beer's law and Lambert's law, Electronic transitions in organic molecule, terms involved in UV-visible Spectroscopy. Instrumentation (double beam spectrophotometer) and its applications.

Unit-III: Synthetic Materials and Green Chemistry 08 Hours

Polymers: Introduction, definition of polymer, monomer, functionality of monomers, classification of polymers. preparation, properties and applications of specialty polymers. Thermoplastic: polycarbonate.

Nanomaterials: Introduction, classification of nanomaterials based on dimensions. Synthesis of nanomaterials structure, properties and applications of graphene, carbon nanotubes, quantum dots.

Green Chemistry: Introduction, principles of green chemistry, atom economy and numerical, green chemistry route synthesis: Friedel-Crafts acylation.

Unit-IV: Fuels and Combustion 08 Hours

Introduction, definition, classification of fuel based on chemical reactions and characteristics of an ideal fuel. Calorific value, higher calorific value and Lower calorific value, Determination of calorific value: Principle, construction and working of Bomb calorimeter and, Solid fuel. Coal: Analysis of Coal-Proximate and numerical, Refining of Petroleum, Octane number, Cetane number, Alternative fuels: Power alcohol and biodiesel. Hydrogen gas as a future fuel.

Unit-V: Corrosion and its Prevention 08 Hours

Introduction, types of corrosion – Dry and wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bedworth's rule, wet corrosion – mechanism: hydrogen evolution and oxygen absorption, Factors influencing rate of corrosion. Methods of corrosion control and prevention: Cathodic Protection (Sacrificial Anode and Impressed Current), metallic coatings and its types, surface preparation, methods to apply metallic coatings-hot dipping, electroplating.

Learning Resources:

Text Books:

1. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd.
2. Engineering Chemistry by O. G. Palanna, Tata Magraw Hill Education Pvt. Ltd.
3. Green Chemistry: A Textbook V.K.Ahluwalia

Reference Books:

1. Basic Concept of Analytical Chemistry, Second Ed., S. M. Khopkar, New Age-International Publisher.
2. Instrumental Methods of Chemical Analysis, G. R. Chatwal& S. K. Anand, Himalaya Publishing House.
3. Spectroscopy of organic compounds, Second Ed., P. S. Kalsi, New Age-International Ltd., Publisher.
4. Polymer Science, V. R. Gowarikar, N. V. Viswanathan, jayadev Sreedhar, Wiley Eastern Limited.
5. Inorganic Chemistry, 5ed, Shriver and Atkins, Oxford University Press.
6. Fundamentals of Nanotechnology, G. L. Hornyak, J. J. Moone, H. F. Tihhale, J. Dutta, CRC press.

Weblink for MOOC / NPTEL Links

1. https://nptel.ac.in/courses/104104011
2. https://nptel.ac.in/courses/104101099

Laboratory Experiments (Any 8 Experiments)

1. To determine hardness of water by EDTA method.
2. To determine alkalinity of water.
3. To determine strength of strong acid using pH meter.
4. To determine maximum wavelength of absorption of CuSO4/FeSO4/ KMnO4, verify Beer's law and find unknown concentration of given sample.
5. Titration of a mixture of weak acid and strong base using conductometer.
6. To determine molecular weight/radius of macromolecule polystyrene/ polyvinyl alcohol by viscosity measurement.
7. Colloidal synthesis of 2-6 or 3-5 semiconductor quantum dots nanoparticles.
8. Proximate analysis of coal.
9. Preparation of biodiesel from oil.
10. To coat copper and zinc on an iron plate using electroplating.
11. Estimation of Iron.

Course Code: 100103	Course Name: Fundamentals of Electronics Engineering	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week **Practical :** 2 Hours/Week	**2** **1**	**CCE :** 40 Marks **ESE :** 60 Marks **TW :** 25 Marks

Prerequisite Courses:

- 11th and 12th Physics.

Course Objectives:

- To understand, apply, and analyze the working of P-N junction diodes and rectifiers in various configurations for practical electronic applications.
- To enable students to understand, apply, and analyze the operation and applications of Bipolar Junction Transistors (BJTs), particularly in switching and amplification, and evaluate their frequency response and bandwidth in practical applications.
- To equip students with the ability to understand, analyze, and apply operational amplifier principles in practical circuits and numerical problems.
- To provide students with the skills to understand, apply, and analyze number systems, logic gates, and basic logic circuits for digital systems design.
- To equip students with the skills to classify, apply, and analyze various sensors, and understand their application in IoT and microprocessor systems.

Course Outcomes:

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

CO1: Understand and Analyze PN Junction Diodes and Rectifiers. To enable learners to understand the construction and operation of PN junction diodes and analyze their performance in rectifier circuits through numerical analysis.

CO2: Understand and Apply BJTs. To facilitate understanding of Bipolar Junction Transistors (BJTs) and apply knowledge of the voltage divider biasing technique, while analyzing the VI characteristics of npn BJTs as switches and amplifiers.

CO3: Understand and Apply Operational Amplifier Principles. To equip students with the ability to understand operational amplifier principles and apply them in practical circuits, along with analyzing related numerical problems.

CO4: Understand and Analyze Logic Circuits. To provide learners with the knowledge of various number systems and basic arithmetic operations for conversions, and to analyze the functionality of basic and universal logic gates.

CO5: Classify and Analyze Sensors in IoT. To enable students to classify different types of sensors, apply selection criteria for their use, and analyze their applications in Internet of Things (IoT) and microprocessor systems.

Course Contents

Unit-I: Electronic Components 06 Hours

Introduction to Active and Passive Components. Symbol, Construction and working of the P-N junction diode under forward and reverse bias conditions, V-I characteristics of a P-N junction diode. P-N junction diode as a switch. P-N junction diode as a half-wave rectifier, full-wave rectifier and bridge rectifier. Expressions for the average output voltage and average output current of rectifiers, Bridge Rectifier with and without Capacitor Filter. Problem statements on P-N Junction Diodes as a Rectifiers.

Unit-II: Bipolar Junction Transistor and Applications 07 Hours

Construction, symbol, and modes of operation of n-p-n & p-n-p BJTs. V-I characteristics of n-p-n BJT in CE mode, DC load line and operating point for n-p-n transistor biasing techniques (voltage divider biasing), n-p-n BJT as a switch & amplifier in CE configuration, Types and comparison of BJTs, Frequency Response of CE BJT Amplifier. Problem statements on gain and bandwidth of CE BJT amplifier.

Unit-III: Operational Amplifier and Applications 06 Hours

Symbol, block diagram of Operational Amplifier, Ideal and Practical Characteristics of OPAMP, OPAMP in Open Loop and Closed Loop Configurations, OPAMP as an inverting & non-inverting amplifier. Problem statements on Inverting & Non-inverting Amplifier.

Unit-IV: Logic Gates and Applications 06 Hours

Number System: Binary, Decimal, Octal, and Hexadecimal number systems, conversion of Binary to Decimal and Decimal to Binary numbers, binary addition and subtraction, Basic Logic Gates (AND, OR, NOT, XOR, XNOR), Universal Gates (NAND, NOR), Boolean laws and expressions, Implement NAND and NOR gates using basic logic gates (AND, OR, NOT), De-Morgan's Theorems (I & II), Half adder and Full adder.

Unit-V: Sensors and IoT 06 Hours

Active & Passive Sensors, Selection Criteria of Sensor, temperature sensors (RTD), Mechanical sensors (Strain Gauge), and Biosensors. Wheatstone Bridge with RTD in balanced and unbalanced conditions. Introduction to IoT, Introduction to Microprocessor and Microcontroller.

List of Practicals:

Group – A (Any Four)

1. Study of Active and Passive components
   a. Resistors (Fixed & Variable), Calculation of resistor value using color code.
   b. Capacitors (Fixed & Variable)
   c. Inductors, Calculation of inductor value using color code.
   d. Devices such as Diode & BJT
   e. Sensors and Transducers
2. Study of –
   a. Switches
   b. Relays
   c. Transformers
3. Measurements using various measuring equipment:
   a. Set up CRO and function generator for measurement of voltage, frequency
   b. Measure voltage, resistance using digital multimeter.
4. Testing of –
   a. Diode
   b. BJT using digital multimeter
5. To study P-N Junction Diode
   a. To plot Volt-Ampere Characteristics of Silicon P-N Junction Diode.
6. Implement bridge rectifier using P-N Junction Diodes
   a. To measure transformer output voltage
   b. To measure rectifier output voltage with and without capacitor filter

Group – B (Any Two)

7. Build and test Bipolar Junction Transistor as a Switch
8. Frequency response of BJT Amplifier
   a. To plot frequency response of BJT CE amplifier. (Simulation)
   b. To find Lower and Higher Cut-off frequencies
   c. To determine the bandwidth
9. OPAMP Amplifiers
   a. Build and test OPAMP-based Inverting amplifier
   b. Build and test OPAMP based Non-inverting amplifier

Group – C (Any Two)

10. Test and verify the truth tables of:
    a. Basic Gates
    b. Universal Gates
11. Test and verify the truth tables of:
    a. Half Adder
    b. Full Adder
12. Test and verify truth tables of De-Morgan's Theorems using basic logic gates
13. Build and test NOT Gate using Bipolar Junction Transistor
14. Build and test circuit using Op-Amp and RTD sensor (Simulation) To implement and test the PT-100 RTD based Signal Conditioning Circuit using Wheatstone bridge.

Learning Resources:

Text Books:

1. A Text Book of Applied Electronics, R. S. Sedha, S. Chand & Company Ltd.
2. Modern Digital Electronics by R. P. Jain, 4th Edition, Tata McGraw Hill
3. Op Amps And Linear Integrated Circuits, Ramakant A. Gayakwad, Pearson
4. Sensors and Transducers by D. Patrnabis, 2nd Edition, PHI
5. Instrumentation and Measurement Principles, D.V.S. Murty, PHI, New Delhi, 2nd Ed.
6. Communication Systems, Analog and Digital, R. P. Singh & S. D. Sapre, Tata McGraw-Hill Education India Pvt. Ltd

Reference Books:

1. Electronic Circuit Analysis and Design, Donald A. Neamen, Tata McGraw-Hill Edition
2. Digital Fundamentals by Thomas. L. Floyd, 11th Edition, Pearson
3. Mobile Communication by J. Schiller, 2nd Edition, Pearson
4. Sensors Handbook, by S. Soloman, 2nd Edition.
5. CMOS Circuit Design, Layout & Simulation, by Baker, 2nd Edition, Wiley IEEE Press

E-Books

1. https://www.pearson.com/en-us/subject-catalog/p/electronic-devices-electron-flow-version/P200000001048

Weblink for MOOC / NPTEL Links

1. https://nptel.ac.in/courses/117103063
2. https://nptel.ac.in/courses/117103064
3. https://archive.nptel.ac.in/courses/106/105/106105166/

Course Code: 100203		Course Name: Basic Electrical Engineering
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week **Practical :** 2 Hours/Week	**2** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Intermediate Physics and Mathematics.

Course Objectives:

- Apply various laws and theorems to solve electrical network problems.
- Analyze the single-phase and poly-phase AC circuits.
- Develop practical skills for analyzing basic DC and AC circuits used in electrical devices.
- Analyze the electrical quantities, basic laws of magnetism along with applications.
- Apply the knowledge of construction, working principle of transformers, DC machine and induction machine.

Course Outcomes:

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

CO1: Analyze DC circuits using basic electrical laws, theorems and network simplification techniques.

CO2: Compute the voltage, current and power for 1-phase and 3-phase AC circuits.

CO3: Analyze the magnetic circuit parameters, self-Inductance and mutual Inductance.

CO4: Demonstrate operation of single-phase transformer and calculate transformer efficiency, regulation at different loading conditions.

CO5: Analyze the performance characteristics of electrical machines.

Course Contents

Unit-I: DC Circuits **06 Hours**

EMF, potential difference, current, power, energy, Ohm's law, and circuit elements (resistance, inductance, capacitance) are foundational concepts. Ideal vs practical sources, source conversion and network classification. Analysis methods using Kirchhoff's laws, Mesh analysis, Superposition theorem, Thevenin's theorem, and star-delta transformations.

Unit-II: AC Circuits **06 Hours**

Study circuits with resistance, inductance, and capacitance; series and parallel RL, RC, and RLC circuits; impedance and admittance; power triangle and power factor. Resonance in series circuits, three-phase AC systems, balanced and unbalanced loads, voltage, current, power and phasor

diagrams for star and delta connections.

Unit-III: Magnetic Circuits **06 Hours**

Fundamentals of magnetic circuits, comparison of electric and magnetic circuits; flux, flux density, MMF, reluctance, permeability; calculations for composite circuits; leakage flux, fringing; Faraday's laws, Fleming's right-hand rule, induced EMF, self and mutual inductance, coefficient of coupling, and energy storage in magnetic fields.

Unit-IV: Single Phase Transformer **06 Hours**

Construction, working principle, EMF equation, transformation ratio, rating, types (core & shell), losses, regulation, and efficiency under different loading conditions, ideal and practical transformer, Introduction to autotransformers.

Unit-V: Electrical Machines **06 Hours**

DC motors: construction, working principles, types, characteristics, and EMF equation. Single-phase induction motors: construction, working principle (double field revolving theory), types (split phase, capacitor start, capacitor run), and applications. Three-phase induction motors: working principle (rotating magnetic field theory), types, and applications.

Learning Resources:

Text Books:

1. B.L. Theraja, "A Textbook on Electrical Technology, Vol-I", S Chand Publications
2. V. K. Mehta, Rohit Mehta, "Basic Electrical Engineering", S Chand Publications
3. J. B. Gupta, "A Textbook of Electrical Engineering", S. K. Kataria & Sons
4. K. Bhattacharya, "Electrical Machines", McGraw Hill Education

Reference Books:

1. C. L. Wadhwa, "Basic Electrical Engineering", New Age International (P)Limited
2. E. Hughes, "Electrical and Electronics Technology", Pearson
3. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill Education
4. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford University Press

Weblink for MOOC / NPTEL Links

1. https://nptel.ac.in/courses/108108076
2. https://onlinecourses.nptel.ac.in/noc20_ee60/preview

List of Practicals (Any 08 Experiments)

1. Study safety precautions while working on electrical systems, handling of various equipments, such as Rheostats, Multi-meters, Ammeters, Voltmeters, Watt-meters, Resistors, Inductors and Capacitors.
2. Study of various wiring components (wires, switches, sockets, plugs) and different types of electrical protection equipment (Fuses, MCB, MCCB, and ELCB).

3. Verify Kirchhoff's laws through practical experimentation.
4. Verify superposition theorem through practical experimentation.
5. Determine the efficiency and regulation of a single-phase transformer at different loading conditions.
6. Measure the steady-state response of series RL and RC circuits.
7. Determine resonance of RLC circuit.
8. Verify the relationship between phase and line quantities in three-phase balanced star and delta connections.
9. Study of cut-view section of single phase/three phase induction motors.
10. Study of LT and HT electricity bills.

Course Code: 100104	Course Name: Engineering Graphics	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week **Practical :** 2 Hours/Week	**2** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Basic geometric shapes, Basic geometrical measurements (linear and angular), Deviation of line, circle and polygon, co-ordinate geometry, Computer literacy.

Course Objectives:

- To cultivate students ability to conceptualize physical objects and effectively translate them onto paper for communication in engineering contexts.
- To enhance manual drawing skills, honing drawing interpretation abilities, and fostering a practical understanding of object dimensions.
- To introduce students to essential drawing and design software tools for a well-rounded skill set.

Course Outcomes:

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

CO1: Explain the fundamentals of Engineering Graphics and basic principles of geometric construction and projections and apply the concepts of projection to draw several 2D views for visualizing the physical state of the object.

CO2: Apply the visualization skill to draw an isometric projection from given orthographic views.

CO3: Apply the types of projections and methods to prepare the drawings for lines and planes.

CO4: Construct the various engineering curves and illustrate the application of various engineering curves.

CO5: Draw the development of the lateral surfaces of solid.

Course Contents

Unit-I: Fundamentals of Engineering Drawing and Orthographic Projection 06 Hours

Fundamentals of Engineering Drawing: Introduction to drawing instruments and their uses, drawing sheets sizes and their layouts, types of lines, dimensioning methods, general rules of dimensioning, lettering etc.

Orthographic Projection: Introduction, principle of projection, plane of projection, method of projection, orthographic projection, first and third angle method of projection, hidden features, curved features, circular features. etc. typical problems by first angle projection method.

Unit-II: Isometric Projection **06 Hours**

Introduction of isometric projection, isometric lines, planes, non-isometric lines and planes, isometric scale, isometric projection and view, construction of isometric view/ projection from given orthographic views. Introduction to 3-D modeling.

Unit-III: Projection of Line and Plane **06 Hours**

Projections of line inclined to both reference planes and plot the traces (first angle projection). Projections of planes when plane resting on HP only and inclined to both reference planes.

Unit-IV: Engineering Curves **06 Hours**

Engineering Curves: Conic Sections- Ellipse, Parabola and Hyperbola by directrix and focus and rectangle method, Helix (one convolution) on Cylinder and Cone, Cycloid, Involute of a circle, Archimedean spiral (one convolution)

Unit-V: Development of Lateral Surfaces **06 Hours**

Introduction to different types of solids. Development of lateral surfaces of right solids, cube, prisms, cylinder, pyramids, and cone with planes cutting to axis.

Learning Resources:

Text Books:

1. Bhatt, N. D. and Panchal, V. M., (2016), “Engineering Drawing”, Charotar Publication, Anand, India
2. K. Venugopal, K, (2015), “Engineering and Graphics”, New Age International, New Delhi
3. Jolhe, D. A., (2015), “Engineering Drawing with introduction to AutoCAD”, Tata McGraw Hill, New Delhi
4. Rathnam, K., (2018), “A First Course in Engineering Drawing”, Springer Nature Singapore Pte. Ltd., Singapore.

Reference Books:

1. Madsen, D. P. and Madsen, D. A., (2016), “Engineering Drawing and design”, Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), “Machine Drawing”, Charotor Publishing House, Anand, India
3. Dhawan, R. K., (2000), “A Textbook of Engineering Drawing”, S. Chand, New Delhi
4. Luzadder, W. J. and Duff, J. M., (1992), “The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production”, Peachpit Press, USA
5. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Loving, R. O., Dygon, J. T., (1990), “Principles of engineering graphics”, McMillan Publishing, USA.

Weblink for MOOC / NPTEL Links

1. NPTEL Course: Engineering Graphics and Design
   https://www.youtube.com/playlist?list=PLp6ek2hDcoNCjoRLQ4rjpCozisCACBxKA
2. NPTEL Course: Introduction and Geometric Construction
   https://archive.nptel.ac.in/content/storage2/courses/112103019/module1/lec3/1.html
3. NPTEL Course: Computer Aided Design and Manufacturing".
   https://archive.nptel.ac.in/courses/112/102/112102101/

List of Practicals:

Guidelines for Practicals: Problems to be drawn on A3 size drawing sheet.

1. Draw Orthographic Projections. (one manually and one using CAD)
2. Draw Isometric Projections. (one manually and one using CAD)
3. Draw Projection of lines and Projection of Planes.(Two on lines and planes each)
4. Draw Engineering Curves.(Four different types of curves)
5. Draw Development of lateral surfaces of solids.(Two different solids)
6. Prepare a 3-D model using CAD.

Course Code:100204		Course Name: Engineering Mechanics
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week **Practical :** 2 Hour/Week	**2** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Basic Calculus, Physics and Trigonometry

Course Objectives:

- Apply knowledge of force systems, equilibrium conditions, and basic mechanical principles to analyze static structures and solve real-world engineering problems involving forces, supports and reactions.
- Apply concepts of the center of gravity, moment of inertia, and particle dynamics, enabling them to design and analyze mechanical components and structures under various loading conditions.

Course Outcomes:

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

CO1: Analyze and resolve force systems into components, apply equilibrium conditions to static systems, and solve problems involving distributed loads, supports, and reactions.

CO2: Determine the center of gravity and the moment of inertia for various shapes and composite bodies, and apply these concepts to solve composite problems.

CO3: Apply methods of joints to analyze trusses, and solve problems related to frictional forces in different types of contact surfaces and conditions.

CO4: Analyze the motion of particles using kinematic equations, vectors, and relative motion principles, and apply these to practical problems involving rectilinear and curvilinear motion.

CO5: Apply Newton's laws and work-energy principles to solve problems involving particle dynamics, including force-mass-acceleration relationships.

Course Contents

Unit-I: Resolution of Forces and Equilibrium **06 Hours**

Introduction of force system, fundamental concepts and principles of force and equilibrium, Types of force system, resolution and composition of forces, moment of a force, Varignon's theorem, resultant of force system, couple, free body diagram, Conditions of equilibrium, equilibrium of forces, Lami's theorem, parallel and general force system, Introduction to space force system, type

of load, type of support, type of beam its support reaction.

Unit-II: Centre of Gravity and Moment of Inertia 06 Hours

Introduction, centroid of line elements, centroid of two-dimensional plane lamina, centroid of two-dimensional composite figure, Theorems of moment of inertia -parallel and perpendicular axis theorem, moment of inertia of two-dimensional, composite figure and Radius of gyration.

Unit-III: Analysis of Truss, Cable and Friction 06 Hours

Trusses, Cables: Introduction, two forces and multi force member, assumptions, concept of statically determinate and indeterminate trusses, identification of zero force members, analysis of determinate trusses by method of joint, method of section and analysis of cables.

Friction: Introduction, sliding and rolling friction, laws of coulomb friction, coefficient of friction, angle of repose, angle of friction, cone of friction, friction on inclined plane, ladder, wedge and flat belt friction.

Unit-IV: Kinematics of Particle 06 Hours

Rectilinear motion of particles: Introduction, rectilinear motion of particles: position, velocity and acceleration, determination of motions of a particle. Uniform rectilinear motion, uniformly accelerated rectilinear motion, motions under gravity.

Curvilinear motion of particles: Position vectors, velocity and accelerations, rectangular components of velocity and acceleration, tangential and normal components. Projectile motion.

Unit-V: Kinetics of Particle 06 Hours

Newton’s second law of motion, equation of motion, application of Newton's second laws to rectilinear and curvilinear motion, conservative and non-conservative forces, application of principle of work energy, conservation of energy, impulse-momentum principle, impact and coefficient of restitution.

Learning Resources:

Text Books:

1. Engineering Mechanics, Ferdinand Singer, 3rd edition, Harper and Row.
2. Engineering Mechanics (Statics and Dynamics) by Hibbeler R. C., Pearson Education.
3. Engineering Mechanics Bhavikatti, Newage Publications, 8th Edition, (2017).
4. Engineering Mechanics, S. Ramamurtham, Dhanpat Rai Publication (2016).
5. Engineering Mechanics, B. N. Thadani, Bombay Publication.
6. Engineering Mechanics, A.K. Tayal, Umesh Publication.

Reference Books:

1. Engineering Mechanics, S Timoshenko and Young, Tata McGraw Hill Education Pvt. Ltd. New Delhi.

2. Engineering Mechanic of Solids, Egor P. Popov, Pearson Publication.
3. Vector Mechanics for Engineers – Statics, Beer and Johnston, Tata McGraw Hill.
4. Vector Mechanics for Engineers – Dynamics, Beer and Johnston, Tata McGraw Hill.
5. Engineering Mechanics - Statics and Dynamics, Meriam J. L. and Kraige L.G., John Wiley and Sons.
6. Engineering Mechanics R. S. Khurmi, S. Chand Publications, 3rd Edition, (2019).
7. Mechanics of Materials by R.C. Hibbeler, Pearson Education publication,10th Edition.

Weblink for MOOC / NPTEL Links

1. http://nptel.ac.in/courses/112103108
2. https://www.coursera.org/learn/engineering-mechanics-statics

List of Practicals:

A. Compulsory experiments

1. Verification of law of polygon forces
2. To find support reaction of simply supported beam
3. To determine coefficient of friction of flat belt.
4. To find the coefficient of restitution

B. Graphical solution of the following

1. Equilibrium of coplanar concurrent force system
2. Equilibrium of coplanar parallel force system
3. Analysis of simple truss to find forces in each member
4. Moment of Inertia

C. Assignment on each unit: Minimum five examples on each unit

Course Code: 100105	Course Name: Fundamentals of Programming	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week **Practical:** 2 Hours/Week	**2** **1**	**CCE :** 40 Marks **ESE :** 60 Marks **TW :** 25 Marks

Prerequisite Course:

- Intermediate mathematics.

Course Objectives:

- To understand Fundamental Concepts of Computer and C language
- To implement Control Statements and Loops in C Programming
- To develop Solutions Using Arrays and Strings
- To become familiar with Functions and Pointers in C programming
- To work with Structures, Unions, and File Handling

Course Outcomes:

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

CO1: Apply foundational elements of C programming

CO2: Apply control flow structures for making decisions

CO3: Develop solution using arrays and strings

CO4: Apply pointers and functions to achieve code reusability

CO5: Design solution using structure, union and file.

Course Contents

Unit-I: Introduction to Computer and C Language 06 Hours

Introduction to Computer: Definition of Computer, Characteristics of Computer, software, hardware, input, output, Nibble, Bit, Byte, Word, double word, KB, MB, GB etc.

Program Design Tools: Algorithm, flowchart, Pseudo code

Basics of C: Editor, compiler, interpreter, programming languages, data type, variable, constants, identifiers, keywords, comments, input output statements; Operators: arithmetic operator, relational operator, logical operators, bitwise operators, operator precedence and associativity.

Unit-II: Control Statements and Loops 06 Hours

Control Statements: if statement, if-else statement, if-else-if ladder, Compound and nested if statement, switch case statement, Go-to statement. **Loop Statements:** while, do while, and for loops, nested loops, continue statement, break statement.

Unit-III: Arrays and Strings 06 Hours

Arrays: Array basic, array types, array declaration, initialization of single dimension array, representation of array in memory, two-dimensional array - initializing and accessing, memory map of two-dimensional array, multidimensional array, applications of arrays.

Strings: Strings basics, strings declaration, strings initialization, NULL terminated string, reading and printing strings, string library functions.

Unit-IV: Function and Pointer 06 Hours

Function: Purpose, declaration, definition, and calling, function parameters, return type and value, passing array to function, introduction to call by value vs call by reference, local and global variables, recursive function – how, when, advantages, and limitations.

Pointer: Pointer concept, pointer variable – declaration and initialization Pointer & and * operators, pointers to different data types, void pointer, pointer memory organization, pointer operations, pass by value vs pass by reference.

UnitT-V: Structure, Union and File Handling 06 Hours

Structure: Defining a structure, accessing structure members, arrays of structures.

Union: Introduction to union, difference between structure and union.

File handling: Introduction to files, types of files: Text files, binary files, file handling operations.

Learning Resources:

Text Books:

1. “Let Us C”, By Yashwant Kanetkar, BPB Publication.
2. “Programming in ANSI C”, By E. Balgurusamy, McGraw Hill Publication.

Reference Books:

1. “C: The Complete Reference”, Herbert Schildt, McGraw Hill Publication.
2. “The C programming Language”, Brian Kernighan and Dennis Ritchie, Pearson Publication.
3. “Understanding Pointers in C”, By Yashwant Kanetkar, BPB Publication.
4. “Programming with C” (Schaum's Outline Series), By Byron Gottfried, McGraw-Hill Publication.

Weblink for MOOC / NPTEL Links

1. NOC: Introduction to programming in C, IIT Kanpur: https://nptel.ac.in/courses/106104128
2. https://www-personal.acfr.usyd.edu.au/tbailey/ctext/ctext.pdf
3. https://karadev.net/uroci/filespdf/files/a%20book%20on%20c.pdf

4. https://www.geeksforgeeks.org/c-programming-language/
5. https://www.freecodecamp.org/news/the-c-programming-handbook-for-beginners/
6. https://www.w3schools.com/c/

Activity based Learning (Suggested Activities in Class)

1. Flipped Classroom
2. Gamification
3. Online Interactive Tool
4. Collaborative and Individual Problem based learning
5. Quizzes/Assignment

Guidelines for Practicals:

1. Course Teacher may frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the respective courses.
2. Preferably there should be multiple sets of assignments and distributed among batches of students.
3. Real world problems / application based assignments create interest among learners serving as foundation for future research/projects.
4. Mini-project can be completed in groups of 4 to 6 students.
5. Use of open source software is to be encouraged.
6. Course Teacher may also set one assignment or mini-project that is suitable to the respective course beyond the scope of syllabus.

Course Code: 100106	Course Name: Workshop Practice	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical : 02 Hours/Week	**1**	**TW :** 25 Marks

Prerequisite Courses:

- Basic science and drawing.

Course Objectives:

- Acquire the basic knowledge of Machine Tools.
- Impart practical aspects of Machine Tools.
- Acquire the basic knowledge of Electronics and Electrical Components.
- Develop the skill through hands-on practices using hand tools, power tools, machine tools in manufacturing and assembly shop.

Course Outcomes:

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

CO1: Illustrate various sections of a typical workshop and different types of tools and machinery commonly found in a workshop.

CO2: Explain the importance of workshop safety and apply general workshop safety rules and guidelines.

CO3: Apply the carpentry/ welding/ solid modeling techniques to develop a component.

CO4: Describe the applications, advantages and operation of advanced computerized machine tools in modern manufacturing.

CO5: Demonstration of Electrical, Electronics, Plumbing etc. tools and components.

List of Practicals:

1. Introduction to workshop facilities, different types of tools and machinery commonly found in a workshop, usage of basic hand tools.
2. Safety Rules and Guidelines: Importance of workshop safety and the potential hazards present, general workshop safety rules and guidelines, emergency procedures including the location and use of emergency equipment (e.g., fire extinguishers, first aid kits).
3. Introduction to measuring instruments like vernier caliper, micrometer screw gauge, vernier height gauge etc.

4. Preparation of simple wooden job having marking, sawing, planning, chiseling operations using different tools such as saws, jack plane, chisel etc. needed for it.
5. Preparation of 3 D models of different solids using card sheets.
6. Welding: Preparation of one simple job having lap or butt welding of plates or fillet welding.
7. Introduction to CNC turning and detailed demonstration of turning process.
8. Demonstration of complete process to prepare a job using 3D printing technology.
9. Introduction to house wiring, different types of cables, types of power supply, types of motors, relays and contractors, earthing and grounding.
10. Identification of electronic components, soldering of components, introduction to printed circuit boards.
11. Plumbing: Types of pipe joints, threading dies, Pipe fittings.

Learning Resources:

Text Books:

1. H.S.Bawa, “Workshop Practice”, Tata McGraw Hill Education (Publisher)
2. S. K. Hajra Choudhary, Nirjhar Roy, “Element of Workshop Technology: Vol.1 and 2”, Media Promoters and Publishers Pvt. Ltd., 15th Edition, 2012.

Reference Books:

1. Mikell P.Groover,“IntroductiontoManufacturingProcesses”,WileyPublications
2. John,K.C., “Mechanical Workshop Practice”, Prentice Hall Publication, New Delhi
3. Chua Chee Kai, Leong Kah Fai, “3D Printing and Additive Manufacturing: Principles &
4. Applications”, 4th Edition, World Scientific, 2015.
5. Automation, Production system & Computer Integrated manufacturing, M. P. Groover Person India, 2007 2nd edition.

Weblink for MOOC / NPTEL Links

1. NPTEL Course on Fundamentals of Additive Manufacturing Technologies by Prof. Sajan Kapil, IIT Guwahati, www.onlinecourses.nptel.ac.in/noc21_me115/preview
2. NPTEL Course on Fundamentals of Industrial safety by Prof. Thomas, IIT Madras www.youtube.com/watch?v=3VReVbsmjKI
3. NPTEL Course on Computer Numeric Control Of Machine Tools And Processes by Prof. A. Roy Chaodhary, IIT Kharagpur www.youtube.com/watch?v=ImtSsDLgAaI&list=PLSGws_74K01-KX9YtVZACpOoFYy6oaJIC

Course Code: 100206	Course Name: Design Thinking and Idea Lab	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical: 2 Hours/Week	**1**	**TW : 25 Marks**

Prerequisite Courses:

- Knowledge of basic science and mathematics, Computer Literacy.

Course Objectives:

- The objectives is to understand and implement the principles of design thinking in context of engineering.

Course Outcomes:

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

CO1: Empathize the problem and define the problem statement.

CO2: Generate innovative ideas to solve the problems.

CO3: Design and make prototype based on the idea generated.

CO4: Test the prototype and analyze for refinement.

CO5: Present and communicate ideas effectively.

Notes: -

1. The practical lab is designed to provide students with hands-on experience in applying the theoretical concepts they have learned in the course. The session aims to enhance their understanding, critical thinking, and problem-solving skills. (1 hour for explaining the concept and 1 hour for activity/ assignment / group discussion / brainstorming session)
2. Incorporating hands-on labs with access to various lab and workshop facilities in the Institute, can enhance the practical aspect of the course and provide students with opportunities to prototype and test their designs.

Weeks	Contents
1-2	Introduction to Design Thinking • Understanding the design thinking process • Role of empathy and user-centric design • Practical Lab: Empathy mapping and user interviews
3-4	Ideation and Creativity • Techniques for idea generation and brainstorming • Practical Lab: Brainstorming sessions
5-6	Prototyping and Testing • Creating prototypes to validate design concepts • Practical Lab: Rapid prototyping
7-8	Analysis and Evaluation • Applying the six hats of design thinking • Practical Lab: Six thinking hats analysis
9-10	Communication and Collaboration • Visual communication and storytelling • Group project and industry collaboration

Term Work:

1. **Assignments:** Student should undertake a case study of a product or service. They have to solve and submit assignments based on steps in Design Thinking. The undertaken case study should be used as a reference while writing assignments.
2. **Project:** Students should identify a real-world problem and solve it by making a prototype. Presentation of the project to be conducted at the end of the semester.

List of Assignments:

1. Problem identification
2. Idea generation and selection
3. Prototyping and user testing
4. Six hats analysis of a case study
5. Design project presentation

Learning Resources:

Reference Books:

1. Design Thinking: Understanding How Designers Think and Work by Nigel Cross.
2. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown.
3. Design Thinking for Visual Communication by Ranjan Nayar and Jaidip Subedi.
4. The Design of Everyday Things by Don Norman Design Thinking: Creativity and Innovation by S. Balara.
5. Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days by Jake Knapp.
6. Creative Confidence: Unleashing the Creative Potential Within Us All by Tom Kelley and David Kelley.

Weblink for MOOC / NPTEL Links

1. Design Thinking - A Primer: https://onlinecourses.nptel.ac.in/noc22_mg32/preview
2. Design Thinking for Innovation: https://www.coursera.org/learn/uva-darden-design-thinking-innovation.

E-books

1. Handbook of Design Thinking - Tips & Tools for how to design thinking by Christian Mueller-Roterberg.

Case Studies:

1. **Design Thinking in Healthcare:** Redesigning a patient's waiting room experience.
2. **Design Thinking in Product Development:** The evolution of the smartphone.
3. **Design Thinking in Social Innovation:** Improving access to clean drinking water in rural areas.
4. **Tata Nano:** The People's Car: Explore how Tata Motors aimed to revolutionize the automobile industry by creating an affordable and compact car for the masses, known as the Tata Nano.
5. **Aravind Eye Care System:** Investigate how Aravind Eye Care System in India used innovative design thinking to provide high-quality, affordable eye care services to a large population, often in remote areas.
6. **Project Shakti by Hindustan Unilever:** Analyze how Hindustan Unilever's Project Shakti empowered rural women in India by turning them into micro-entrepreneurs, distributing Unilever products in their communities.

7. **AADHAAR: India's Unique Identification Program:** Explore how the Aadhaar program used biometric data and design thinking to provide millions of Indians with a unique identification system, enhancing access to government services and benefits.
8. **Ola Cabs:** Transforming Transportation in India: Learn how Ola, an Indian ride-sharing platform, disrupted the traditional taxi industry by applying innovative design thinking to its services and business model.
9. **Swiggy: Redefining Food Delivery:** Investigate how Swiggy, an Indian food delivery platform, leveraged design thinking to enhance the food delivery experience for customers and partner restaurants.
10. **Lifebuoy: Promoting Hygiene in Rural India:** Explore how Lifebuoy, a brand under Unilever, used design thinking to develop innovative marketing campaigns and products to promote handwashing and hygiene in rural India.
11. **Amul: The White Revolution in India:** Analyze how the Amul cooperative transformed the dairy industry in India through a unique business model, design thinking, and innovative marketing strategies
12. **Flipkart: E-commerce Success Story:** Study how Flipkart, one of India's leading e-commerce platforms, employed design thinking to grow its business and offer a wide range of products and services.
13. **ISRO's Mars Orbiter Mission**: Learn about how the Indian Space Research Organisation (ISRO) successfully launched the Mars Orbiter Mission (Mangalyaan) on a limited budget, showcasing innovation and design thinking in space exploration.
14. **Designing Google's Self-Driving Car:** Explore how Google used design thinking to develop autonomous vehicles that redefine transportation.
15. **Dyson**: Revolutionizing Vacuum Cleaners and Hand Dryers: Investigate how Dyson's innovative design thinking has transformed household appliances.
16. **SpaceX**: Advancing Space Exploration through Design Thinking: Analyze SpaceX's approach to space technology and how it has disrupted the aerospace industry.
17. **Red Bull**: Creating an Energy Drink Empire: Learn how Red Bull's unique design thinking approach contributed to the success of their energy drink and brand.
18. **McDonald's**: Evolution of Fast Food Service: Study the design thinking principles applied by McDonald's to enhance their customer experience and streamline operations.
19. **Nest**: Reinventing Thermostats and Home Automation: Examine how Nest Labs, a subsidiary of Google, reimagined home automation with their smart thermostats and other products.
20. **LEGO:** Building a Design-Centric Toy Empire: Investigate how LEGO has used design

thinking to create a global brand that fosters creativity and learning through play.

21. **IBM Design Thinking:** A Cultural Transformation: Explore IBM's adoption of design thinking to reshape its corporate culture and enhance its software and services.
22. **Starbucks**: Brewing Design Innovation in the Coffee Industry: Analyze how Starbucks incorporates design thinking into its store layouts, product offerings, and customer experiences.
23. **Amazon: Customer-Centric** Design in E-commerce: Discover how Amazon's design thinking philosophy has played a pivotal role in its e-commerce dominance.

Course Code: 100107	Course Name: Professional Communication Skills	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Tutorial : 2 Hours/Week	**2**	**TW : 25 Marks**

Prerequisite Courses:

- English- Basic Knowledge of Listening Speaking, Reading,Writing (LSRW) Skills.

Course Objectives:

- To develop desired communication patterns among the students.

Course Outcomes:

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

CO1: Recognize proficient oral and written communication skills tailored to engineeringcontexts, fostering effective technical exchanges and collaboration.

CO2: Develop the writing skills in societal and professional life.

CO3: Develop oratory skills through public speaking and elocution activities.

CO4: Apply the knowledge of professional attire in corporate environment.

CO5: Apply the business etiquette and inculcate the etiquette for corporate field.

Course Contents

Unit-I: Workplace Communication **06 Hours**

Introducing yourself and others, accepting and declining invitation, greetings (formal and informal), asking for information.

Unit-II: Business Writing **06 Hours**

External Communication: The Seven C's of Letter writing - Kinds of BusinessLetters, Business Reports, Business Meeting Minutes, and C.V Writing; **Internal Communication:** Format and Principles of Writing Memos.

Unit-III: Oral Communication **06 Hours**

Listening: Definition - Types of Listening Skills - Features of a Good Listener. **Public Speaking:** Types of Public Speaking - Importance of Public Speaking.

Unit-IV: Behavioral Techniques **06 Hours**

Body Language: Facial Expressions, body posture, gestures, eye contact, touch and the use of personal space. **Business Attire and Grooming:** Different types of Attire-guidelines for business Attire.

Unit-V: Etiquettes 06 Hours

Professional: Greeting Etiquette, corporate etiquette, telephone etiquette, E-mail etiquette, meeting etiquette, interview Etiquette. **Personal:** Social etiquette, dining Etiquette.

Learning Resources:

Text Books:

1. Communication Skills for Engineers by S. Mishra & C. Murali Krishnan (Pearson).
2. Professional Communication by Dr. P. Prasad
3. Technical Communication by Dr. Ritu Soryan.

Reference Books:

1. Communication Skills for Engineers and Scientists by Whiting, H.G., and Rycroft,
2. Lesikar: Basic Business Communication, TMH
3. Teamwork and Project Management" by Karl A. Smith and Ruth W. Crumbly

Web link for MOOC / NPTEL Links

1. https://youtu.be/vULoIGxBYA4

List of Assignments:

1. Ice Breaker
2. Story Telling Activity
3. Preparation of Reports on different issues.
4. Role Play
5. Square Talk Activity
6. Public Speaking Exercises
7. Elocution
8. Self-Introduction on Different Occasion (Formal and Informal)
9. SWOT Analysis
10. Group Discussion
11. Telephonic Activity
12. Making Resume
13. Fluency Focused Activity
14. Mock Interview Activity

Course Code:100108	Course Name: Co-Curricular Courses - I	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical: 4 Hours/Week	**2**	**TW : 25 Marks**

Course Guidelines:

1. **Course Selection**: Students will choose one course from the provided list based on their interests.
2. **Course Allocation**: Each student will be allocated a specific course, ensuring focused engagement.
3. **Expert Instruction**: Classes will be conducted by experts in each course, using a mix of activities, discussions, presentations, and lectures, either on campus or online.
4. **Activity Documentation**: Students must submit a hard copy report detailing the activities performed related to their chosen course, along with a certificate of participation.
5. **Evaluation Criteria**: Assessment will be based on the quality and completeness of the submitted activity report.
6. **Mentorship**: Faculty members will be assigned as mentors to guide students through their chosen course, supporting them in their activities.
7. **Activity Framework**: Faculty, in collaboration with course experts, will design a list of activities for students to undertake, ensuring alignment with learning objectives.
8. **Personal Growth**: Emphasis is placed on selecting courses that align with personal interests and goals, enhancing the educational experience and fostering enthusiasm.
9. **Balance and Engagement**: Students are encouraged to maintain a balance in their selections, opting for courses they are genuinely excited about to maximize their learning outcomes.

Basket of Co-curricular Courses:

1. **Physical Fitness/ Health and Wellness**: Focuses on various exercises and routines to improve overall health, strength, endurance, and physical health, nutrition, mental well-being, and holistic practices to promote a balanced lifestyle.
2. **Yoga Education and Meditation**: Teaches various yoga practices, including asanas, pranayama, and philosophy, emphasizing mind-body connection and stress relief and Introduces techniques for mindfulness and relaxation, helping participants enhance concentration and reduce anxiety.

3. **Dancing**: Covers different dance styles, improving physical fitness, creativity, and self-expression through movement.
4. **Music Composition and Singing**: Provides foundational skills in creating music, including melody, harmony, and rhythm, encouraging creativity and self-expression and basics of singing and vocal techniques.
5. **Physical Fitness**: Focuses on various exercises and routines to improve overall health, strength, and endurance.
6. **Visual Arts**: Explores different forms of visual art, including drawing and sculpture, promoting creativity and critical thinking.
7. **Personality Development**: Aims to enhance self-awareness, communication skills, and emotional intelligence, contributing to personal growth.
8. **Content Creation**: Focuses on developing skills in creating digital content across various platforms (e.g., blogs, videos, social media). Students learn about audience engagement, branding, and effective communication.

Learning Resources:

Text Books:

1. Singh, D. K. (2010). Principle and History of Physical Education and Sports. Sports Publication, New Delhi.
2. Kansal, D. K. (2008). Textbook of Applied Measurement Evaluation & Sports Selection. Sports and Spiritual Science Publication, New Delhi.
3. Iyengar, B.K. (2008).Light on Yoga. Orient LongmanPvt. Ltd.Mumbai
4. Gharote, M. L. (2013). Guidelines for Yogic Practices. The Lonavla Yoga Institute. India.

Reference Books:

1. Kamlesh, M. L. (2011). Fundamental Elements of Physical Education. KSK Publishers & Distributors. New Delhi
2. Hoeger, W.W. K., & Hoeger, S.A. (2007). Fitness and Wellness. Thomas learning. Wadsworth.
3. Gharote, M. L. (2013). Guidelines for Yogic Practices. The Lonavla Yoga Institute. India.
4. Iyengar, B.K. (2008). Yoga the Path to Holistic Health. Dorling Kindersley. London.

Semester - II

Course Code:100201		Course Name: Engineering Mathematics-II
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 3 Hours/Week **Tutorial :** 1 Hour/Week	**3** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Basic concepts of mathematics covered in junior college: Differentiation, integration, plane and solid geometry, measures of central tendency & dispersion.

Course Objectives:

- To make the students familiarize with mathematical modeling of physical systems using differential equations advanced techniques of integration, multiple integrals and their applications.
- To equip students with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

Course Outcomes:

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

CO1: Apply effective mathematical tools for solving first order ordinary differential equations.

CO2: Use physical laws & ordinary differential equations to model and analyze physical systems.

CO3: Apply integration techniques such as reduction formulae, beta functions, gamma functions, differentiation under integral sign to evaluate integrals.

CO4: Evaluate multiple integrals and their applications to find area bounded by curves, volume enclosed by surfaces.

CO5: Apply statistical methods such as correlation & regression analysis to analyze experimental data.

Course Contents

Unit-I: First Order Ordinary Differential Equation **8 Hours**

Exact differential equations, Equations reducible to exact form. Linear differential equations, Equations reducible to linear form.

Unit-II: Applications of Differential Equations **8 Hours**

Applications of differential equations to orthogonal trajectories, Law of decay and growth, Newton's law of cooling, Kirchhoff's law of electrical circuits, rectilinear motion, one dimensional conduction of heat.

Unit-III: Integral Calculus **8 Hours**

Reduction formulae, beta, gamma functions and their properties, differentiation under integral sign first and second rule.

Unit-IV: Multiple Integrals and Applications **9 Hours**

Relation between three coordinate systems, double and triple integrations, change of order of integration, transformation to polar coordinate system, Dirichlet's Theorem (without proof), applications of multiple integral to find area, volume.

Unit-V: Statistics **7 Hours**

Moments, skewness, kurtosis, correlation, line of regression.

Learning Resources:

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson)
5. Applied Mathematics (Vol. I & Vol. II) by P.N.Wartikar and P.N.Wartikar Vidyarthi Griha Prakashan, Pune.

Web link for MOOC / NPTEL Links

1. https://www.youtube.com/playlist?list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5

Tutorials:

1. Tutorial for the subject shall be conducted in minimum three batches (batch size of 22 students maximum) per division.
2. Term work shall be awarded on the basis of performance of students during tutorials as continuous internal assessment.

Course Code: 100205	Course Name: Programming and Problem Solving	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week **Practical:** 2 Hours/Week	**2** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks**

Prerequisite Courses:

- 100105 Fundamentals of Programming.

Course Objectives:

- To understand fundamental concepts for problem solving in Python.
- To implement control statements and loops.
- To develop solutions using data structures, strings and various operations performed on them.
- To work with functions and modules.
- To perform data handling using the Object Oriented Programming concepts and Python Libraries.

Course Outcomes:

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

CO1: Use fundamental concepts for problem solving.

CO2: Apply suitable decision control statement for problem solving.

CO3: Demonstrate operations on data structures and strings.

CO4: Implement modular programs using functions and modules.

CO5: Apply object oriented programming concepts and Python libraries for data handling.

Course Contents

Unit-I: Introduction to Python **06 Hours**

General Problem-Solving Concepts: Problem-solving in everyday life, Problem-solving with computers, Difficulties with problem-solving, Problem-Solving strategies.

Basics of Python Programming: Features of Python, History of Python, Introduction to IDEs, Writing and Executing First Python Program, Basic Data types, Input / Output Operations, Interactive and Script Mode: Comments, Reserved Words, Indentation, Variables and Identifiers.

Operators and Expressions: Arithmetic, Logical, Assignment, Bitwise, Comparison, Identity, Membership.

Unit-II: Decision Control Statements 06 Hours

Selection / Conditional Branching Statements: if, if-else, nested if, if-elif-else statements.

Basic loop Structures / Iterative statements: while loop, for loop, selecting appropriate loop, Nested loops, break, continue, pass, else statement used with loops.

Unit-III: Data Structures and Strings 06 Hours

Lists: Creating a list, accessing list elements, modifying list elements, slicing in lists, list operations.

Tuple: Creating a tuple, working with a tuple, immutability, and tuple operations.

Dictionary: Creating a dictionary, adding elements to a dictionary, accessing elements of a dictionary, dictionary methods.

Strings: Operations on strings, Built-in string functions, immutability, Strings formatting operator, Identity and Membership operators, Comparing strings, Iterating strings.

Unit-IV: Functions and Modules 06 Hours

Introduction to functions: function definition, Types of Functions: Built-in functions, User defined functions: Defining, Calling, return statement, Types of arguments: Positional, keyword, default and variable length arguments, Variable scope: Local, Global variables, Lambda Function/ Anonymous function, Recursive Functions.

Introduction to Modules: Built-in and user-defined.

Unit-V: Introduction to Object Oriented Programming and Python Libraries 06 Hours

Features of Object oriented programming (OOP): Classes, Objects, Methods and Message passing, Inheritance, Polymorphism, Reusability, Data abstraction and Encapsulation, Classes and Objects: Creating a class, Constructor, Types of variables, Instance method.

Python Libraries:

The world of arrays with NumPy: Creating an array, Mathematical operations: Array subtraction, Squaring an array, Trigonometric function performed on the array, Conditional operations, Matrix multiplication, Indexing, and slicing, Shape manipulation.

Empowering data analysis with pandas: The data structure of pandas: Series, Data Frame and Panel.

Matplotlib Basics: Plotting with Matplotlib, Creating basic plots.

Learning Resources:

Text Books:

1. Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford University Press, ISBN: 9780199480173

2. Samir Madhavan, “Mastering Python for Data Science”, Packt Publishing Ltd. ISBN: 978-1-78439-015-0

Reference Books:

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308
2. Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, ISBN-10:9789387572942, ISBN-13: 978-9387572942
3. Dr. Jisu Elsa Jacob, Bharath Viswam S, "Python Programming", Katson Books, ISBN: 9789350147375
4. Alberto Boschetti, Luca Massaron, “Python Data Science Essentials”, Third Edition, Packt Publishing Ltd., Birmingham, ISBN: 978-1-78953-786-4
5. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly, ISBN: 978-1-491-91205-8

Weblink for MOOC / NPTEL Links

1. Programming in Python, By Dr. Rizwan Rehman, Dibrugarh University https://onlinecourses.swayam2.ac.in/cec24_cs11/preview
2. Python 3.4.3, Spoken Tutorial Project, Indian Institute of Technology Bombay https://spoken-tutorial.org/tutorial-search/?search_foss=Python+3.4.3&search_language=English
3. The Joy of Computing using Python, By Prof. Sudarshan Iyengar, IIT Ropar, https://onlinecourses.nptel.ac.in/noc24_cs113/preview
4. Python for Data Science, By Prof. Ragunathan Rengasamy, IIT Madras https://onlinecourses.nptel.ac.in/noc24_cs68/preview

Activity based Learning (Suggested Activities in Class)

1. Flipped Classroom
2. Gamification
3. Online Interactive Tool
4. Collaborative and Individual Problem based learning
5. Quizzes/Assignments

List of Practicals:

1. Course Teacher / Lab Instructor may frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the respective courses.
2. Preferably there should be multiple sets of assignments and distributed among batches of

students.

3. Real world problems / application based assignments create interest among learners serving as foundation for future research/projects.
4. Mini-project can be completed in groups of 4 to 6 students.
5. Use of open source software is to be encouraged.
6. Instructors may also set one assignment or mini-project that is suitable to the respective course beyond the scope of syllabus.

Course Code: 100207		Course Name: Indian Knowledge System
Teaching Scheme	**Credit**	**Evaluation Scheme**
Tutorial : 2 Hours/Week	**02**	**TW : 25 Marks**

Prerequisite Courses:

- Basic knowledge of classical Indian languages, Basic mathematics, Astronomy, Physics, Architecture.

Course Objectives:

- To introduce students to the rich heritage of Indian Knowledge Systems (IKS) and their relevance to modern engineering practices.
- To develop an understanding of how Indian technological principles and innovations can be integrated with modern technology.

Course Outcomes:

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

CO1: Demonstrate knowledge of ancient Indian contributions to science, mathematics, and engineering, and their impact on modern practices.

CO2: Analyze traditional Indian architectural and engineering methods and apply them in contemporary contexts.

CO3: Apply Indian philosophical concepts to resolve ethical dilemmas in engineering.

CO4: Design innovative solutions that integrate Indian Knowledge Systems with modern technology for sustainable development.

Course Contents

Unit-I: Introduction to Indian Knowledge Systems 06 Hours

Overview of Indian Knowledge Systems (IKS). Understanding the vedic tradition. Introduction to different branches of IKS: Science, mathematics, arts and philosophy. Relevance of IKS in modern engineering and technology.

Unit-II: Fundamental concepts in Science and Technology 06 Hours

Language System. Contributions of ancient India in mathematics: Arithmetic, algebra, geometry, trigonometry and calculus. Number system and units of measurements. Knowledge: Framework and classification. Ancient Indian astronomy and its impact on modern science. Metallurgy and material sciences in ancient India. Dyes and painting technologies. Agriculture technology.

Unit-III: Applications of Science, Engineering and Technology 06 Hours

Indian Architecture: Temples, forts, and urban planning. Vastushatra. Structural engineering in ancient India: Use of arches, domes and columns. Sustainable construction practices from IKS. Irrigation systems. Rain water harvesting and water conservation systems. Shipbuilding.

Unit-IV: Indian Philosophy and its Relevance to Engineering Ethics 06 Hours

Introduction to Indian Philosophy: Dharma, karma, and the concept of ethics. Learnings from Gita. Relevance of Indian ethical practices in engineering. Arthshatra - Governance and administration. Administrative setup and public administrations. Case studies on ethical dilemmas and resolutions from IKS.

Unit-V: Integration of Indian Knowledge Systems with Modern Technology 06 Hours

Role of IKS in sustainable development. Health, wellness and psychology. Modern innovations inspired by IKS (e.g., ayurveda and biotechnology). Future prospects of integrating IKS with emerging technologies.

Learning Resources:

Text Books:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi.
2. Kapoor Kapil, Singh Avadhesh (2021). "Indian Knowledge Systems Vol – I & II", Indian Institute of Advanced Study, Shimla, H.P.

Reference Books:

1. Datta, B. and Singh, A.N. (1962). History of Hindu Mathematics: Parts I and II, Asia Publishing House, Mumbai.
2. Kak, S.C. (1987). "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), pp. 205–221.
3. Subbarayappa, B.V. and Sarma, K.V. (1985). Indian Astronomy: A Source Book, Nehru Centre, Mumbai.
4. Bag, A.K. (1997). History of Technology in India, Vol. I, Indian National Science Academy, New Delhi.
5. Acarya, P.K. (1996). Indian Architecture, MunshiramManoharlal Publishers, New Delhi.
6. Banerjea, P. (1916). Public Administration in Ancient India, Macmillan, London.

MOOC / NPTEL/YouTube Links

1. Indian Knowledge System(IKS): Concepts and Applications in Engineering https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

Term Work:

Sr. No.	Assignments	Marks
1.	Identify and analyze a traditional Indian engineering practice (e.g., ancient water harvesting systems) and compare it with modern practices.	5
2.	Create a mathematical model or solve problems using ancient Indian mathematical methods (e.g., Aryabhata's algorithms).	5
3.	Visit a historical monument and prepare a report analyzing its structural design and sustainability aspects based on IKS principles.	5
4.	Analyze a modern engineering ethical dilemma through the lens of Indian philosophical concepts and provide a reasoned solution.	5
5.	Develop a concept or prototype that integrates traditional Indian knowledge with modern technology.	5

Course Code:100208	Course Name: Co-Curricular Course-II	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical: 4 Hours/Week	**2**	**TW:** 25 Marks

Course Guidelines:

Students are required to go through the list of following Co-curricular Courses and select any one of their interests. They will be allocated one course from the list. Experts from respective courses will conduct classes on campus/Online through activities, discussions, presentations, and lecture methods. Students are required to submit a hard copy of a report along with a certificate on the activities performed related to topics of the opted Co-curricular Course. Evaluation will be done based on the report of activities submitted by the student. Faculty members will be allotted for mentoring the activities related to Co-curricular Course topic. Faculty members will frame the list activities to be performed by students with the help of experts in respective courses. Selecting co-curricular courses that align with your interests and goals can significantly enrich your educational journey. Remember to maintain a balance and choose courses that you are genuinely excited about. This approach will help you gain the most from your co-curricular activities.

Basket of Co-curricular Courses:

1. Sports
2. NSS
3. Fine Arts
4. Applied Arts
5. Performing Arts
6. Self Defense for Women
7. Jeevan Vidya (Work Life Balance)
8. Design Thinking
9. Principle Centered Leadership
10. Mentoring of School Children
11. Basics of Fire Safety

Here are some tips and ideas to help you choose the right courses:

1. **Consider your Interests and Hobbies.** Think about what you enjoy doing in your free time or what activities you have always wanted to try. Co-curricular courses can be a great opportunity to pursue passions outside your major.

2. **Explore Different Fields:** Choosing courses from different areas can provide a well-rounded experience. For instance, you might pick one course related to arts, another in sports, and a third in community service.
3. **Balance Your Schedule:** Ensure that the co-curricular courses fit well with your academic schedule and personal commitments. Avoid overloading yourself, as these courses should enhance your experience, not add undue stress.
4. **Look at Course Benefits:** Some co-curricular courses offer skills that can be beneficial in your future career or personal development. For example, leadership training, public speaking, or project management.
5. **Consult with Advisors or Seniors:** Talking to academic advisors, professors, or senior students can give you insights into which courses are popular, have good instructors, or offer valuable experiences.