



**PRAKASAM ENGINEERING COLLEGE
(AUTONOMOUS)
KANDUKUR**

MECHANICAL ENGINEERING (R23-IInd YEAR COURSE STRUCTURE & SYLLABUS)

MECHANICAL ENGINEERING (R23-IInd YEAR COURSE STRUCTURE & SYLLABUS)

B.Tech II Year I Semester

| S.No. | Category | Title | L | T | P | Credits |
|--------------|--------------------------|---|-----------|----------|-----------|-----------|
| 1 | BS | Numerical Methods and Transform Techniques | 3 | 0 | 0 | 3 |
| 2 | HSMC | Universal Human Values– Understanding Harmony& Ethical Human Conduct | 2 | 1 | 0 | 3 |
| 3 | Engineering Science | Thermo dynamics | 2 | 0 | 0 | 2 |
| 4 | Professional Core | Mechanics of Solids | 3 | 0 | 0 | 3 |
| 5 | Professional Core | Material Science and Metallurgy | 3 | 0 | 0 | 3 |
| 6 | Professional Core | Mechanics of Solids and Materials Science Lab | 0 | 0 | 3 | 1.5 |
| 7 | Professional Core | Computer-aided Machine Drawing | 0 | 0 | 3 | 1.5 |
| 8 | Engineering Science | Python programming Lab | 0 | 0 | 2 | 1.0 |
| 9 | Skill Enhancement Course | Embedded Systems and IoT | 0 | 1 | 2 | 2 |
| 10 | Audit Course | Environmental Science | 2 | 0 | 0 | - |
| Total | | | 15 | 2 | 10 | 20 |



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II Year I Semester

NUMERICAL METHODS AND TRANSFORM TECHNIQUES

Course Objectives:

- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Outcomes:

1. Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
2. Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3)
3. Apply the Laplace transform for solving differential equations (L3)
4. Find or compute the Fourier series of periodic signals (L3)
5. Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)

UNIT – I: Iterative Methods:

Introduction – Solutions of algebraic and transcendental equations: Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (Simultaneous Equations)

Interpolation: Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula

UNIT – II: Numerical integration, Solution of ordinary differential equations with initial conditions:

Trapezoidal rule– Simpson's $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method –Runge-Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.

UNIT –III: Laplace Transforms:

Definition of Laplace transform - Laplace transforms of standard functions – Properties of Laplace Transforms – Shifting theorems–Transforms of derivatives and integrals – Unit step



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function – Dirac's delta function – Inverse Laplace transforms – Convolution theorem (with out proof).

Applications: Solving ordinary differential equations (initial value problems) and integro differential equations using Laplace transforms.

UNIT – IV: Fourier series:

Introduction– Periodic functions – Fourier series of periodic function –Dirichlet's conditions – Even and odd functions –Change of interval– Half-range sine and cosine series.

UNIT – V: Fourier Transforms:

Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Infinite Fourier transforms – Sine and cosine transforms – Properties– Inverse transforms – Convolution theorem (without proof) – Finite Fourier transforms.

Text Books:

1. **B. S. Grewal**, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Steven C. Chapra**, Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
3. **M. K. Jain, S.R.K. Iyengar and R.K. Jain**, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
4. **Lawrence Turyn**, Advanced Engineering Mathematics, CRC Press.



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II Year-I Semester

| L | T | P | C |
|---|---|---|---|
| 2 | 1 | 0 | 3 |

**UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY& ETHICAL
HUMAN CONDUCT**

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education



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Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

- UNIT II** Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
- Lecture 7: Understanding Human being as the Co-existence of the self and the body.
- Lecture 8: Distinguishing between the Needs of the self and the body
- Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
- Lecture 9: The body as an Instrument of the self
- Lecture 10: Understanding Harmony in the self
- Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
- Lecture 11: Harmony of the self with the body
- Lecture 12: Programme to ensure self-regulation and Health
- Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body
- UNIT III** Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
- Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
- Lecture 14: 'Trust' – the Foundational Value in Relationship
- Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
- Lecture 15: 'Respect' – as the Right Evaluation
- Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
- Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
- Lecture 17: Understanding Harmony in the Society
- Lecture 18: Vision for the Universal Human Order
- Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal
- UNIT IV** Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
- Lecture 19: Understanding Harmony in the Nature
- Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
- Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
- Lecture 21: Realizing Existence as Co-existence at All Levels
- Lecture 22: The Holistic Perception of Harmony in Existence
- Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.



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UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a. [The Textbook](#)



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R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria, *Teachers' Manual for A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. *Jeevan Vidya: Ek Parichaya*, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautiful* - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – Pandit Sunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad
12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.



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It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf>
3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>
4. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>
6. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf>
7. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview



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THERMO DYNAMICS

II Year-I Semester

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Course Objectives

- Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.
- Explain relationships between properties of matter and basic laws of thermodynamics.
- Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- Introduce the concept of available energy for maximum work conversion.
- Provide fundamental concepts of Refrigeration and Psychrometry.

Unit - I

Introduction: Basic Concepts : System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility

Unit -II

Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroeth Law of Thermodynamics – PMM-I, Joule's Experiment – First law of Thermodynamics and applications. Limitations of the First Law – Enthalpy, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.

Unit - III

Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

Unit - IV

Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Unit – V

Introduction to Refrigeration: working of Air,Vapour compression,VCR system Components, COP Refrigerants.

Introduction to Air Conditioning: Psychrometric properties & processes – characterization of sensible and latent heat loads – load concepts of SHF.



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Requirements of human comfort and concept of effective temperature- comfort chart – comfort air conditioning, and load calculations.

Text Books:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009.

Reference Books

1. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e, Prentice Hall, 1995.
2. Y.A.Cengel & M.A.Boles, Thermodynamics – An Engineering Approach, 7/e, McGraw Hill, 2010.
3. P.Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011.
4. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021.

Online Learning Resources:

- <https://www.edx.org/learn/thermodynamics>.
- <https://archive.nptel.ac.in/courses/112/106/112106310>.
- <https://www.youtube.com/watch?v=7NI5P4KqrAs&t=1s>
- https://kp.kiit.ac.in/pdf_files/02/Study-Material_3rd-Semester_Winter_2021_Mechanical-Engg.-Thermal-Engineering-1_Abhijit-Samant.pdf
- <https://www.coursera.org/learn/thermodynamics-intro>

Course Outcomes:

| COs | Statements | Blooms Level |
|-----|---|--------------|
| CO1 | Explain the importance of thermodynamic properties related to conversion of heat energy into work. | L3 |
| CO2 | Apply the Zeroeth and First Law of Thermodynamics. | L3 |
| CO3 | Understand Second Law of Thermodynamics. | L2 |
| CO4 | Analyze the Mollier charts, T-S and h-s diagrams, Steam calorimetry, Phase Transformations | L4 |
| CO5 | Evaluate the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads. | L5 |



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II Year I Semester

MECHANICS OF SOLIDS

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| 3 | 0 | 0 | 3 |

Course Objectives: The objectives of the course are to

- Understand the behavior of basic structural members subjected to uni axial and bi axial loads.
- Apply the concept of stress and strain to analyse and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
- Students will learn all the methods to analyse beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyse beams and draw correct and complete shear and bending moment diagrams for beams.
- Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior
- Design and analysis of Industrial components like pressure vessels.

UNIT- I

SIMPLE STRESSES & STRAINS : Elasticity and plasticity – Types of stresses & strains– Hooke’s law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson’s ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr’s circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT-II

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT-III

FLEXURAL STRESSES : Theory of simple bending, Derivation of bending equation, Determination of bending stresses – section modulus of rectangular, circular, I and T sections– Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I and T sections.

UNIT-IV

DEFLECTION OF BEAMS : Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay’s methods – Determination of slope and deflection for cantilever and simply



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supported beams subjected to point loads, UDL and UVL. Mohr's theorem and Moment area method – application to simple cases.

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT– V

THIN AND THICK CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells. Wire wound thin cylinders. Lamé's equation – cylinders subjected to inside & outside pressures – compound cylinders.

COLUMNS:

Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula

Text Books:

1. GH Ryder, Strength of materials, Palgrave Macmillan publishers India Ltd, 1961.
2. B.C. Punmia, Strength of materials, 10/e, Lakshmi publications Pvt. Ltd, New Delhi, 2018.

Reference Books:

1. Gere & Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.
2. U.C. Jindal, Strength of Materials, 2/e, Pearson Education, 2017.
3. Timoshenko, Strength of Materials Part – I & II, 3/e, CBS Publishers, 2004.
4. Andrew Pytel and Ferdinand L. Singer, Strength of Materials, 4/e, Longman Publications, 1990.
5. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc19_ce18/preview.
- https://youtube/iY_ypychVNY?si=310htc4ksTQJ8Fv6.
- https://www.youtube.com/watch?v=WEy939Rkd_M&t=2s
- <https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204>
- <https://www.coursera.org/learn/mechanics-1>
- <https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-1-linear-elastic-behavior>
- <https://archive.nptel.ac.in/courses/112/107/112107146/>



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Course Outcomes:

| COs | Statements | Blooms Level |
|------------|--|---------------------|
| CO1 | Learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components | L1 |
| CO2 | Analyse beams and draw correct and complete shear and bending moment diagrams for beams. | L4 |
| CO3 | Apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, and moments. | L3 |
| CO4 | Model & Analyze the behavior of basic structural members subjected to various loads | L4 |
| CO5 | Design and analysis of Industrial components like pressure vessels. | L6 |



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MATERIAL SCIENCE & METALLURGY

Course Objective:

- Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
- Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains
- Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
- Grasp the methods of making of metal powders and applications of powder metallurgy
- Comprehend the properties and applications of ceramic, composites and other advanced methods

UNIT- I

Structure of Metals and Constitution of alloys: Crystallization of metals, Packing Factor - SC, BCC, FCC & HCP-line density, plane density. Grain and grain boundaries, effect of grain boundaries— determination of grain size. Imperfections, Slip and Twinning.

Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphism alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe₃C.

UNIT-II

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast iron. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys: Structure and properties of Copper and its alloys, Aluminum and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT-III

Heat treatment of Steels: Effect of alloying elements on Fe-Fe₃C system, annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, age hardening treatment, Cryogenic treatment.

UNIT-IV

Powder Metallurgy: Basic processes- Methods of producing metal powders- milling atomization- Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Secondary operations, Applications of powder metallurgical products.



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UNIT– V

Ceramic and Advanced materials: Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, manufacturing methods, particle reinforced composites, fiber reinforced composites, PMC, MMC, CMC and CCCs. Introduction to Nano materials and smart materials.

Text Books:

1. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
2. Donald R.Askeland, Essentials of Materials science and Engineering, 4/e, CL Engineering publications, 2018.

Reference Books:

1. Dr. V.D.kodgire, Material Science and Metallurgy, 39/e, Everest Publishing House, 2017.
2. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
3. William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.
5. Yip-Wah Chung, Introduction to Material Science and Engineering, 2/e, CRC Press, 2022.
6. A V K Suryanarayana, Material Science and Metallurgy, B S Publications, 2014.
7. U. C. Jindal, Material Science and Metallurgy, 1/e, Pearson Publications, 2011.

Online Learning Resources:

- <https://archive.nptel.ac.in/courses/113/106/113106032/>
- <https://www.edx.org/learn/mechanics/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-3-time-dependent-behavior>.
- <https://www.youtube.com/watch?v=9Sf278j1GTU>
- <https://www.coursera.org/learn/fundamentals-of-materials-science>
- <https://www.coursera.org/learn/material-behavior>.

Course Outcomes:

| COs | Statements | Blooms Level |
|-----|--|--------------|
| CO1 | Understand the crystalline structure of different metals and study the stability of phases in different alloy systems. | L2 |
| CO2 | Study the behavior of ferrous and non-ferrous metals and alloys and their application in different domains. | L1 |
| CO3 | Understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals. | L2 |
| CO4 | Grasp the methods of making of metal powders and applications of powder metallurgy. | L3 |
| CO5 | Comprehend the properties and applications of ceramic, composites and other advanced methods. | L4 |



**PRAKASAM ENGINEERING COLLEGE
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MECHANICAL ENGINEERING (R23-IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year I Semester

| L | T | P | C |
|---|---|---|-----|
| 0 | 0 | 3 | 1.5 |

MECHANICS OF SOLIDS & MATERIALS SCIENCE LAB

Course Objective:

- Evaluate the values of yield stress, ultimate stress and bending stress of the given specimen under tension test and bending test
- Conduct the torsion test to determine the modulus of rigidity of given specimen.
- Justify the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
- Examine the stiffness of the open coil and closed coil spring and grade them.
- Analyze the microstructure and characteristics of ferrous and non ferrous alloy specimens.

NOTE: Any 6 experiments from each section A and B.

A) MECHANICS OF SOLIDS LAB:

1. Tensile test
2. Bending test on
 - a) Simply supported beam
 - b) Cantilever beam
3. Torsion test
4. Hardness test
 - a) Brinell's hardness test
 - b) Rockwell hardness test
 - c) Vickers hardness test
5. Test on springs
6. Impact test
 - a) Charpy test
 - b) Izod test
7. Punch shear test
8. Liquid penetration test

B) MATERIAL SCIENCE LAB:

1. Preparation and study of the Microstructure of pure metals.
2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, and High carbon steels.
3. Study of the Microstructures of Cast Irons.
4. Study of the Microstructures of Non-Ferrous alloys.
5. Study of the Microstructures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.



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Virtual lab:

1. To investigate the principal stresses σ_a and σ_b at any given point of a structural element or machine component when it is in a state of plane stress. (<https://virtual-labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html>)
2. To find the impact resistance of mild steel and cast iron. (<https://sm-nitk.vlabs.ac.in/exp/izod-impact-test>).
3. To find the impact resistance of mild steel. (<https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/index.html>)
4. To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc. (<https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test>)
5. To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine. (<https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test>).

Course Outcomes:

| COs | Statements | Blooms Level |
|-----|---|--------------|
| CO1 | Understand the stress strain behavior of different materials. | L2 |
| CO2 | Evaluate the hardness of different materials. | L4 |
| CO3 | Explain the relation between elastic constants and hardness of materials. | L1 |
| CO4 | Identify various microstructures of steels and cast irons. | L3 |
| CO5 | Evaluate hardness of treated and untreated steels. | L4 |



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COMPUTER-AIDED MACHINE DRAWING

II Year I Semester

| L | T | P | C |
|---|---|---|-----|
| 0 | 0 | 3 | 1.5 |

Course Objectives

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D and 3D assembly drawings and Familiarize with limits, fits, and tolerances in mating components

The following are to be done by any 2D software package

Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldham's coupling.

The following exercises are to be done by any 3D software package:

Sectional views:

Creating solid models of complex machine parts and sectional views.

Assembly drawings:(Any four of the following using solid model software)

Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling.

Production drawing:

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Textbooks:

- 1 Machine Drawing by K.L.Narayana, P.Kannaiah and K.Venkat Reddy, New Age International Publishers, 3/e, 2014
- 2 Machine drawing by N.Sideswar, P. Kannaiah, V.V.S.Sastry, TMH Publishers. 2014.



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MECHANICAL ENGINEERING (R23-IInd YEAR COURSE STRUCTURE & SYLLABUS)

Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014.

Online Learning Resources:

- <https://eedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf>
- <https://archive.nptel.ac.in/courses/112/105/112105294/>
- https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked_from=autocomplete&c=autocomplete
- https://www.youtube.com/watch?v=0bQkS3_3Fq4

Course Outcomes:

| COs | Statements | Blooms Level |
|-----|---|--------------|
| CO1 | Demonstrate the conventional representations of materials and machine components. | L3 |
| CO2 | Model riveted, welded and key joints using CAD system. | L6 |
| CO3 | Create solid models and sectional views of machine components. | L6 |
| CO4 | Generate solid models of machine parts and assemble them. | L5 |
| CO5 | Translate 3D assemblies into 2D drawings. | L6 |



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MECHANICAL ENGINEERING (R23-IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year I Semester

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

PYTHON PROGRAMMING LAB

Course Objectives:

1. **Fundamental Understanding:** Develop a solid foundation in Python programming, covering essential syntax, semantics, and constructs.
2. **Data Manipulation:** Equip students with skills to handle and manipulate data using Python libraries like Pandas and NumPy.
3. **Problem-Solving:** Enhance problem-solving abilities by implementing various algorithms and data structures in Python.
4. **Software Development:** Foster software development skills, including version control, package management, and project documentation.
5. **Advanced Techniques:** Introduce advanced Python topics such as web scraping, API interaction, and database management.

Experiment 1: Introduction to Python

- Objective: Install Python and set up the development environment.
- Tasks:
 - Install Python and an IDE (e.g., PyCharm, VSCode, or Jupyter Notebook).
 - Write and run a simple "Hello, World!" program.
 - Understand and demonstrate basic Python syntax and semantics.

Experiment 2: Basic Python Programming

- Objective: Learn basic programming constructs in Python.
- Tasks:
 - Create programs using variables, data types, and operators.
 - Implement basic input and output functions.
 - Write programs using control structures (if statements, for loops, while loops).

Experiment 3: Functions and Modules

- Objective: Understand functions and module usage in Python.
- Tasks:
 - Define and call functions with different types of arguments and return values.
 - Explore and use built-in Python modules.
 - Write a script that imports and utilizes at least two different standard library modules.

Experiment 4: Lists and Tuples

- Objective: Work with Python lists and tuples.
- Tasks:
 - Create, modify, and iterate over lists and tuples.
 - Perform list comprehensions to create new lists.
 - Demonstrate the immutability of tuples.

Experiment 5: Dictionaries and Sets

- Objective: Explore dictionaries and sets in Python.
- Tasks:
 - Create and manipulate dictionaries.
 - Use dictionary comprehension.



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- Create and perform operations on sets.

Experiment 6: Strings and File I/O

- Objective: Manipulate strings and perform file I/O operations.
- Tasks:
 - Demonstrate various string methods.
 - Write programs to read from and write to text files.
 - Work with different file formats, including CSV and JSON.

Experiment 7: Error Handling and Exceptions

- Objective: Implement error handling in Python programs.
- Tasks:
 - Write programs using try, except, else, and finally blocks.
 - Handle specific exceptions.
 - Create and raise custom exceptions.

Experiment 8: Object-Oriented Programming (OOP)

- Objective: Understand and implement OOP concepts in Python.
- Tasks:
 - Define classes and create objects.
 - Demonstrate inheritance and polymorphism.
 - Use class and instance variables in programs.

Experiment 9: Libraries and Packages

- Objective: Utilize third-party libraries and create Python packages.
- Tasks:
 - Install and use libraries like NumPy and Pandas.
 - Create a simple Python package and distribute it.
 - Work with virtual environments to manage dependencies.

Experiment 10: Working with Data

- Objective: Perform data manipulation and visualization.
- Tasks:
 - Use Pandas to load, manipulate, and analyze datasets.
 - Create visualizations using Matplotlib and Seaborn.
 - Conduct basic data analysis tasks and summarize findings.

Experiment 11: Web Scraping and APIs

- Objective: Extract data from the web and interact with APIs.
- Tasks:
 - Access and parse data from RESTful APIs.
 - Process and analyze JSON data from APIs.

Experiment 12: Databases

- ****Objective:**** Work with databases in Python.
- ****Tasks:****
 - Connect to a database using SQLite and SQLAlchemy.
 - Perform CRUD operations on the database.
 - Write queries to manage and retrieve data.



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Course Outcomes:

- https://www.udemy.com/course/python-the-complete-python-developer-course/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaign=BG-Python_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=udemys&utm_source=bing&utm_term=.ag_1220458320107116.ad.kw_Python+language.de.c.dm.pl.ti_kwd-76278984197882%3Aloc-90.li_116074.pd.&couponCode=IND21PM
 - https://www.w3schools.com/python/python_intro.asp
 - <https://www.youtube.com/watch?v=eWRfhZUzrAc>
 - https://onlinecourses.nptel.ac.in/noc20_cs83/preview
 - <https://www.edx.org/learn/python>
 - Virtual Labs - <https://python-iitk.vlabs.ac.in/>
 - Virtual Labs - <https://virtual-labs.github.io/exp-arithmetic-operations-iitk/>
 - Virtual Labs - <https://cse02-iiith.vlabs.ac.in/>
- https://mlritm.ac.in/assets/cse/cse_lab_manuals/R20_cse_manuals/Python%20Lab%20Manual.pdf



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MECHANICAL ENGINEERING (R23-IIInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year I Semester

EMBEDDED SYSTEMS & IoT

Course Objectives:

- To comprehend Microcontroller-Transducers Interface techniques
- To establish Serial Communication link with Arduino
- To analyse basics of SPI interface.
- To interface Stepper Motor with Arduino
- To analyse Accelerometer interface techniques
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices.

Embedded Systems Experiments: (Any 5 experiments from the following)

1. Measure Analog signal from Temperature Sensor.
2. Generate PWM output.
3. Drive single character generation on Hyper Terminal.
4. Drive a given string on Hyper Terminal.
5. Full duplex Link establishment using Hyper terminal.
6. Drive a given value on a 8 bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on Hyper Terminal.

COMPONENTS/ BOARDS: 1. Arduino Duemilanove Board 2. Arduino Software IDE.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
4. Embedded Systems-Lyla B.Das-Pearson Publications,2013.

Internet of Things Experiments: (Any 5 experiments from the following)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
3. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.
4. Raspberry Pi interact with online services through the use of public APIs and SDKs.
5. Study and Install IDE of Arduino and different types of Arduino.
6. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
7. Calculate the distance using distance sensor Using Arduino.



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8. Basic LED functionality Using Arduino.
9. Calculate temperature using temperature sensor Using Arduino.
10. Calculate the distance using distance sensor Using Node MCU.
11. Basic LED functionality Using Node MCU.

Text Books:

1. Arsheep Bahga & Vijay Madisetti, Internet of Things - A Hands-on Approach, 1/e, Orient Blackswan Private Limited - New Delhi, 2015.
2. Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,.

Online Learning Sources

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview
3. <https://archive.nptel.ac.in/courses/108/105/108105057/>
4. [https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin-embedded-systems-shape-the-world-microcontroller-input-output?index=product & objectID=course-785cf551-7f66-4350-b736-64a93427b4db & webview=false & campaign=Embedded+Systems+-+Shape+The+World%3A+Microcontroller+Input%2F Output & source=edX & product_category=course & placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems](https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin-embedded-systems-shape-the-world-microcontroller-input-output?index=product&objectID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-+Shape+The+World%3A+Microcontroller+Input%2F+Output&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems)
5. [https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of-things?index=product&queryID=e1322674dcb3d246be981d0669265399&position=4 &linked_from=autocomplete&c=autocomplete](https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of-things?index=product&queryID=e1322674dcb3d246be981d0669265399&position=4&linked_from=autocomplete&c=autocomplete)
6. [https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3 &results_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product_c ategory=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch](https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3&results_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch)
7. Virtual Labs - <http://vlabs.iitkgp.ac.in/rtes/>
8. Virtual Labs - <https://cse02-iiith.vlabs.ac.in/>
9. Virtual Labs - <https://iotvirtuallab.github.io/vlab/Experiments/index.html>



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MECHANICAL ENGINEERING (R23-IInd YEAR COURSE STRUCTURE & SYLLABUS)

Course Outcomes:

| COs | Statements | Blooms Level |
|------------|---|---------------------|
| CO1 | Comprehend Microcontroller-Transducers Interface techniques. | L4 |
| CO2 | Establish Serial Communication link with Arduino | L6 |
| CO3 | Analyse basics of SPI interface. | L4 |
| CO4 | Understand the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor. | L2 |
| CO5 | Realize the revolution of internet in mobile devices, cloud and sensor networks | L3 |



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II Year I Semester

| L | T | P | C |
|---|---|---|----|
| 2 | 0 | 0 | -- |

ENVIRONMENTAL SCIENCE

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

UNIT – I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

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

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

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

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:



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- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

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

UNIT – IV

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

UNIT – V

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

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Erach Bharucha, Text book of Environmental Studies for Undergraduate Courses, Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.



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2. M.Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
- <http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf>
- <https://www.youtube.com/watch?v=5QxxaVfgQ3k>

Course Outcomes:

| COs | Statements | Blooms Level |
|-----|--|--------------|
| CO1 | asp multi disciplinary nature of environmental studies and various renewable and non-renewable resources. | L2 |
| CO2 | derstand flow and bio-geo- chemical cycles and ecological pyramids. | L2 |
| CO3 | derstand various causes of pollution and solid waste management and related preventive measures. | L2 |
| CO4 | derstand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation. | L2 |
| CO5 | ustrate the causes of population explosion, value education and welfare programmes. | L3 |



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B.Tech.-I Year I Semester for Group-A Branches (CSE, EEE)

| S.No. | Category | Title | L/D | T | P | Credits |
|--------------|----------------------------|--|-----------|-----------|-----------|-------------|
| 1 | BS&H | CommunicativeEnglish | 2 | 0 | 0 | 2 |
| 2 | BS&H | Engineering Chemistry/ Chemistry/Fundamental Chemistry | 3 | 0 | 0 | 3 |
| 3 | BS&H | LinearAlgebra&Calculus | 3 | 0 | 0 | 3 |
| 4 | Engineering Science | BasicCivil&Mechanical Engineering | 3 | 0 | 0 | 3 |
| 5 | Engineering Science | IntroductiontoProgramming | 3 | 0 | 0 | 3 |
| 6 | BS&H | CommunicativeEnglishLab | 0 | 0 | 2 | 1 |
| 7 | BS&H | EngineeringChemistry/ Chemistry/FundamentalChemistryLab | 0 | 0 | 2 | 1 |
| 8 | Engineering Science | EngineeringWorkshop | 0 | 0 | 3 | 1.5 |
| 9 | Engineering Science | ComputerProgrammingLab | 0 | 0 | 3 | 1.5 |
| 10 | BS&H | Healthandwellness,YogaandSports | - | - | 1 | 0.5 |
| Total | | | 14 | 00 | 11 | 19.5 |

B.Tech.- I Year I Semester for Group- B Branches (Civil Engineering, Mechanical Engineering, ECE, CSE-Allied)

| S.No. | Category | Title | L/D | T | P | Credits |
|--------------|----------------------------|--|-----------|-----------|-----------|-------------|
| 1 | BS&H | EngineeringPhysics | 3 | 0 | 0 | 3 |
| 2 | BS&H | LinearAlgebra&Calculus | 3 | 0 | 0 | 3 |
| 3 | Engineering Science | BasicElectrical&Electronics Engineering | 3 | 0 | 0 | 3 |
| 4 | Engineering Science | EngineeringGraphics | 1 | 0 | 4 | 3 |
| 5 | Engineering Science | IntroductiontoProgramming | 3 | 0 | 0 | 3 |
| 6 | Engineering Science | ITWorkshop | 0 | 0 | 2 | 1 |
| 7 | BS&H | EngineeringPhysicsLab | 0 | 0 | 2 | 1 |
| 8 | Engineering Science | Electrical&ElectronicsEngineering Workshop | 0 | 0 | 3 | 1.5 |
| 9 | Engineering Science | ComputerProgrammingLab | 0 | 0 | 3 | 1.5 |
| 10 | BS&H | NSS/NCC/Scouts& Guides/CommunityService | - | - | 1 | 0.5 |
| Total | | | 13 | 00 | 15 | 20.5 |



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FIRSTYEARSYLLABUS



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BASIC CIVIL AND MECHANICAL ENGINEERING
(Common to All branches of Engineering)

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

Course Outcomes: On completion of the course, the student should be able to:

- CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.
- CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
- CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.
- CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.
- CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering- Scope of each discipline- Building Construction and Planning- Construction Materials- Cement- Aggregate- Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT II

Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling- Simple problems on levelling and bearings- Contour mapping.



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UNIT III

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water-Specifications-Introduction to Hydrology–Rain water Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:

1. Basic Civil Engineering, M.S.Palanisamy,, Tata McGraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S.Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol-I and Vol-II, S.K.Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures- Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER—SPECIFICATION IS 10500-2012.



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PART B: BASIC MECHANICAL ENGINEERING

Course Objectives: The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes: On completion of the course, the student should be able to

CO1: Understand the different manufacturing processes.

CO2: Explain the basics of thermal engineering and its applications.

CO3: Describe the working of different mechanical power transmission systems and power plants.

CO4: Describe the basics of robotics and its applications.

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III

Power plants – Working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission- Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics- Joints & links, configurations, and applications of robotics.

(Note: This subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject.)



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Textbooks:

1. InternalCombustionEnginesbyV.Ganesan,ByTataMcGrawHillpublications(India) Pvt. Ltd.
2. AtextbookofTheoryofMachinesbyS.S.Rattan,TataMcGrawHillPublications, (India) Pvt. Ltd.
3. AnintroductiontoMechanicalEnggbyJonathanWickerandKemperLewis,Cengage learning India Pvt. Ltd.

ReferenceBooks:

1. G.ShanmugamandM.S.Palanisamy,BasicCivilandtheMechanicalEngineering,Tata McGraw Hill publications (India) Pvt. Ltd.
2. ThermalEngineeringbyMaheshMRathoreTataMcGrawHillpublications(India)Pvt. Ltd.
3. 3Dprinting&AdditiveManufacturingTechnology-L.JyothishKumar,PulakM Pandey, Springer publications
4. AppuuKuttanKK,Robotics,I.K.InternationalPublishingHousePvt.Ltd.Volume-I



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ENGINEERING WORKSHOP

(Common to All branches of Engineering)

Course Objectives:

To familiarize students with woodworking, sheet metal operations, fitting, electrical house wiring skills, and basic repairs of two-wheeler vehicle.

Course Outcomes:

CO1: Identify workshop tools and the preoperational capabilities.

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, and foundry and welding.

CO3: Apply fitting operations in various applications.

CO4: Apply basic electrical engineering knowledge for House Wiring Practice

SYLLABUS

1. Demonstration: Safety practices and precautions to be observed in workshop.
2. Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints.
 - a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
 - a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises.
 - a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. Electrical Wiring: Familiarity with different types of basic electrical circuits and make the following connections.
 - a) Parallel and series b) Two-ways switch c) Godown lighting
 - d) Tube light e) Three phase motor f) Soldering of wires
6. Foundry Trade: Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. Welding Shop: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. Plumbing: Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.
9. Basic repairs of Two-wheeler vehicle – Demonstration of working of two-wheeler vehicle and its repairs.



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Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 20



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| 1 | 0 | 4 | 3 |

ENGINEERING GRAPHICS

(Common to All branches of Engineering)

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

Course Outcomes:

CO1: Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.

CO2: Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.

CO3: Understand and draw projection of solids in various positions in first quadrant. CO4:

Explain principles behind development of surfaces.

CO5: Prepare isometric and perspective section of simple solids.

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involute, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes



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Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D & 3D drawings of objects including PC Band Transformations using Auto CAD (*Not for end examination*).

Textbook:

1. N.D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kanniah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B. Shah and B.C. Rana, Pearson Education Inc, 2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.