

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(An Autonomous College under JNTUA, Anantapuramu,
Approved by AICTE, Accredited by NBA, Accredited by NAAC with 'A' Grade)
Vidya Nagar, Pallavolu (V), Proddatur-516362 (A.P) India



Department of Mechanical Engineering Syllabus in Mechanical Engineering

R 23 REGULATIONS

HEAD, Dept. of Mechanical Engineering
Chaitanya Bharathi Institute of Technology
(Autonomous)
Vidyanagar, PRODDATUR, Y.S.R. (Dt.) A.P.-516360

Controller of Examinations
Chaitanya Bharathi Institute of Technology
(Autonomous)
Vidyanagar, PRODDATUR, Y.S.R. (Dt.) A.P.-516360

PRINCIPAL
Chaitanya Bharathi Institute of Technology
(Autonomous)
Vidyanagar, PRODDATUR, Y.S.R. (Dt.) A.P.-516360

B.TECH. - MECHANICAL ENGINEERING**II YEAR COURSE STRUCTURE & SYLLABI****B. Tech. - II Year I Semester**

Sl. No	Course Code	Course Title	Contract Periods per week			Credits	Int. Marks	Ex. Marks	Total Marks
			L	T	P				
1	23E00303T	NUMERICAL METHODS & TRANSFORM TECHNIQUES	3	0	0	3	30	70	100
2	23E00306T	UNIVERSAL HUMAN VALUES 2- UNDERSTANDING HARMONY & ETHICAL HUMAN CONDUCT	2	1	0	3	30	70	100
3	23E03301T	THERMODYNAMICS	2	0	0	2	30	70	100
4	23E03302T	MECHANICS OF SOLIDS	3	0	0	3	30	70	100
5	23E03303T	MATERIAL SCIENCE AND METALLURGY	3	0	0	3	30	70	100
6	23E03302L	MECHANICS OF SOLIDS AND MATERIALS SCIENCE LAB	0	0	3	1.5	30	70	100
7	23E03304L	COMPUTER-AIDED MACHINE DRAWING	0	0	3	1.5	30	70	100
8	23E03305L	EMBEDDED SYSTEMS & IOT	0	0	2	1	30	70	100
9	23E05303SC	PYTHON PROGRAMMING	0	1	2	2	30	70	100
10	23E00301MC	ENVIRONMENTAL SCIENCE	2	0	0	0	30	00	30
Total			15	2	10	20	300	630	930

B.Tech.- II Year II Semester

Sl. No	Course Code	Course Title	Contract Periods per week			Credits	Int. Marks	Ex. Marks	Total Marks
			L	T	P				
1	23E00407T	INDUSTRIAL MANAGEMENT	2	0	0	2	30	70	100
2	23E00401T	COMPLEX VARIABLES, PROBABILITY AND STATISTICS	3	0	0	3	30	70	100
3	23E03401T	MANUFACTURING PROCESSES	3	0	0	3	30	70	100
4	23E03402T	FLUID MECHANICS AND HYDRAULIC MACHINES	3	0	0	3	30	70	100
5	23E03403T	THEORY OF MACHINES	3	0	0	3	30	70	100
6	23E03402L	FLUID MECHANICS AND HYDRAULIC MACHINES LAB	0	0	3	1.5	30	70	100
7	23E03401L	MANUFACTURING PROCESSES LAB	0	0	3	1.5	30	70	100
8	23E00406SC	SOFT SKILLS	0	1	2	2	30	70	100
9	23E00404MC	DESIGN THINKING FOR INNOVATION	1	0	2	2	30	70	100
Total			15	1	10	21	270	630	900
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation									

II B. Tech. – I Semester

(23E00303T) NUMERICAL METHODS & TRANSFORM TECHNIQUES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	0	0	3

PREREQUISITES: Basics of Numerical Calculation

COURSE OBJECTIVES

- This course aims at providing the student with the knowledge on various numerical methods for solving equations.
- The student develops the idea of using by interpolating the polynomials.
- The student develops the idea of using Laplace, Fourier transforms and Fourier series.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Apply numerical methods to solve algebraic and transcendental equations
CO2 : Derive interpolating polynomials using interpolation formulae
CO3 : Solve differential and integral equations numerically
CO4 : Understand the use of Laplace transform in system modeling, digital signal processing, process control, solving Boundary Value Problems.
CO5 : Apply Fourier series and Fourier transform in communication theory and signal analysis, image processing and filters, data processing and analysis, solving partial differential equations for problems on gravity.

DETAILED SYLLABUS:

UNIT-I: Solution of Algebraic & Transcendental Equations

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method System of Algebraic equations: Gauss Elimination, Jacoby and Gauss Siedal method.

UNIT-II: Interpolation

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.

UNIT-III: Solution of Initial Value Problems To Ordinary Differential Equations

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).

UNIT-IV: Laplace Transforms

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, transforms of derivatives and integrals – Unit step function – Second shifting theorem- Convolution theorem – Laplace transform of Periodic function.

UNIT-V: Fourier Series And Fourier Transforms

Fourier series: Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series -Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions

Fourier transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem.

TEXTBOOKS:

1. S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2018, 10th Edition.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publications, 2014, Third Edition (Reprint 2021)
4. Alan Jeffrey, Advanced Engineering Mathematics, Elsevier

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma05/preview
3. <http://nptel.ac.in/courses/111105090>

CBIT

II B. Tech. – I Semester

(23E00306T) UNIVERSAL HUMAN VALUES 2 – UNDERSTANDING HARMONY & ETHICAL HUMAN CONDUCT

(Common to All Branches of Engineering)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	2	1	0	3

PREREQUISITES: NIL

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

- CO1 : Define the terms like Natural Acceptance, Happiness and Prosperity
CO2 : Identify one's self, and one's surroundings (family, society nature)
CO3 : Apply what they have learnt to their own self in different day-to-day settings in real life
CO4 : Relate human values with human relationship and human society.
CO5 : Justify the need for universal human values and harmonious existence

DETAILED SYLLABUS:

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

Lecture 4: 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

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

TEXTBOOKS:

1. 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".
2. 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. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, 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 – PanditSunderlal
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.

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%2023.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

II B. Tech. – I Semester

(23E03301T) THERMODYNAMICS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	2	0	0	2

PREREQUISITES: Physics, Mathematics

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.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

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

DETAILED SYLLABUS:

UNIT-I: Introduction

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

Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth 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: Thermodynamic Laws

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: Thermodynamic Process

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

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

TEXTBOOKS:

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:

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

CBIT

II B. Tech. – I Semester

(23E03302T) MECHANICS OF SOLIDS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	0	0	3

PREREQUISITES: Engineering Mechanics

COURSE OBJECTIVES

- Understand the behaviour of basic structural members subjected to uniaxial and biaxial 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.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- 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
- CO2 : Analyse beams and draw correct and complete shear and bending moment diagrams for beams.
- 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.
- CO4 : Model & Analyze the behavior of basic structural members subjected to various loads
- CO5 : Design and analysis of Industrial components like pressure vessels.

DETAILED SYLLABUS:

UNIT-I: Simple Stresses & Strains

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

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 And Shear Stresses

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 And Torsion:

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 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 And Columns

Thin And Thick Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, length 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

TEXTBOOKS:

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:

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

II B. Tech. – I Semester

(23E03303T) MATERIAL SCIENCE AND METALLURGY

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	0	0	3

PREREQUISITES: Basic Mechanical Engineering

COURSE OBJECTIVES

- 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

COURSE OUTCOMES: After successful completion of the course, students will be able to:

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

DETAILED SYLLABUS:

UNIT-I: Structure of Metals And Constitution of Alloys

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, Isomorphous 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 And Non-Ferrous Metals And alloys

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, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT-III: Heat Treatment of Steels

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

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.

UNIT-V: Ceramic and Advanced Materials

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.

TEXTBOOKS:

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, JohnWiley 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:

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

II B. Tech. – I Semester

(23E03302L) MECHANICS OF SOLIDS AND MATERIAL SCIENCE LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	0	0	3	1.5

PREREQUISITES: Engineering Mechanics

COURSE OBJECTIVES

- 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 alloys specimens.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Understand the stress strain behavior of different materials.
CO2 : Evaluate the hardness of different materials.
CO3 : Explain the relation between elastic constants and hardness of materials.
CO4 : Identify various microstructures of steels and cast irons.
CO5 : Evaluate hardness of treated and untreated steels.

DETAILED SYLLABUS:

List of Experiments

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.

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>).

CBIT

II B. Tech. – I Semester

(23E03304L) COMPUTER-AIDED MACHINE DRAWING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	0	0	3	1.5

PREREQUISITES: Engineering Graphics

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

COURSE OUTCOMES: After successful completion of the course, students will be able to:

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

DETAILED SYLLABUS:

LIST OF EXPERIMENTS

The following are to be done by any 2D software package Conventional representation of materials and components:

1. **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.
2. **Riveted Joints:** Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.
3. **Welded Joints:** Lap joint and T joint with fillet, butt joint with conventions.
4. **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.

1. **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.
2. **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.Sideshwar, P. Kannaiah, V.V.S.Sastry, TMH Publishers. 2014.

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:

1. <https://eedocs.wordpress.com/wpcontent/uploads/2014/02/machinedrawing.pdf>
2. <https://archive.nptel.ac.in/courses/112/105/112105294/>
3. https://www.youtube.com/watch?v=0bQkS3_3Fq4
4. <https://www.edx.org/learn/autocad>
5. <https://www.edx.org/learn/drawing>

CBIT

II B. Tech. – I Semester

(23E03305L) EMBEDDED SYSTEMS & IOT

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	0	0	2	1

PREREQUISITES: NIL

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.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

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

DETAILED SYLLABUS:

LIST OF EXPERIMENTS

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.

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.
8. Basic LED functionality Using Arduino and Node MCU.
9. Calculate the moisture content in the soil using Arduino and Node MCU.
10. Calculate the distance using distance sensor Using Node MCU.
11. Basic LED functionality Using Node MCU.

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.

CBIT

II B. Tech. – I Semester

**(23E05303SC) PYTHON PROGRAMMING
(SKILL ENHANCEMENT COURSE)**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	0	1	2	2

PREREQUISITES: NIL

COURSE OBJECTIVES

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Classify data structures of Python
CO2 : Apply Python programming concepts to solve a variety of computational problems
CO3 : Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs
CO4 : Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas
CO5 : Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries
CO6 : Propose new solutions to computational problems

DETAILED SYLLABUS:

LIST OF EXPERIMENTS

UNIT-I: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif...else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
 - i) Arithmetic Operators
 - ii) Relational Operators
 - iii) Assignment Operators
 - iv) Logical Operators
 - v) Bit wise Operators
 - vi) Ternary Operator
 - vii) Membership Operators
 - viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II: Functions Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line

Arguments. Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
 - i. Addition
 - ii. Insertion
 - iii. slicing
12. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III: Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

UNIT-IV: Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V: Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
 - a) Apply head () function to the pandas data frame
 - b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

ONLINE LEARNING RESOURCES/VIRTUAL LABS:

1. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
2. <https://www.coursera.org/learn/python?specialization=python#syllabus>

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%2FOutput&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-devalenciaintroductiontotheinternetofthings?index=product&queryID=e1322674dcb3d246be981d066926599&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-9257-1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&pro

- duct_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>

CBIT

II B. Tech. – I Semester

(23E00301MC) ENVIRONMENTAL SCIENCE

(Common to, ECE, EEE, CE, ME, CSE, CSE(AI), CSE(AI & ML) and CSE(DS))

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	00	30	2	0	0	0

PREREQUISITES: NIL

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.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- CO2 : Understand flow and bio-geo- chemical cycles and ecological pyramids.
- CO3 : Understand various causes of pollution and solid waste management and related preventive measures.
- CO4 : About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- CO5 : Casus of population explosion, value education and welfare programs.

DETAILED SYLLABUS:

UNIT –I: Multidisciplinary Nature of Environmental Studies & Natural Resources

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

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 0 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 And Solid Waste Management

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

- 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

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

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. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

REFERENCES:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
2. M.Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prenticehall of India Private limited
5. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.
7. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
8. <https://www.coursera.org/learn/python?specialization=python#syllabus>

II B. Tech. – II Semester

(23E00407T) INDUSTRIAL MANAGEMENT

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	2	0	0	2

PREREQUISITES:

COURSE OBJECTIVES

- Introduce the scope and role of industrial engineering and the techniques for optimal design of layouts
- Illustrate how work study is used to improve productivity
- Explain TQM and quality control techniques
- Introduce financial management aspects and
- Discuss human resource management and value analysis.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Learn about how to design the optimal layout
CO2 : Demonstrate work study methods
CO3 : Explain Quality Control techniques
CO4 : Discuss the financial management aspects
CO5 : Understand the human resource management methods.

DETAILED SYLLABUS:

UNIT-I: Introduction & Plant Layout

Introduction: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, quantitative tool so FIE and productivity measurement. Concepts of management, importance, functions of management, scientific management, Taylor's principles, Fayol's principles of management.

Plant Layout: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts.

UNIT-II: Work Study

Work Study: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

UNIT-III: Statistical Quality Control & Total Quality Management

Statistical Quality Control: Quality control, Queuing assurance and its importance, SQC, attribute sampling inspection with single and double sampling, Control charts-X and R -charts X and S charts and their applications, simple numerical examples.

Total Quality Management: Elements of TQM – Continuous Improvement – zero defect concept, quality circles, implementation, applications, ISO quality systems. Six Sigma- definition, basic concepts.

UNIT-IV: Financial Management:

Financial Management: Scope and nature of financial management, Sources of finance, Management of working capital, estimation of working capital requirements, budget and budgetary control, Capital budgeting – Nature of Investment Decisions– Investment Evaluation criteria-NPV, IRR, PI, Payback Period, and ARR, numerical problems.

UNIT-V: Value Analysis & Human Resource Management

Human Resource Management: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, and types.

Value Analysis: Value engineering, implementation procedure, enterprise resource planning and supply chain management.

TEXT BOOKS:

1. O.P.Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd.
2. Mart and Telsang, Industrial Engineering and Production Management, S.Chand & Company Ltd. New Delhi

REFERENCE BOOKS:

1. Bhattacharya DK, Industrial Management, S.Chand, publishers.
2. J.G Monks, Operations Management, 3/e, McGraw Hill Publishers.
3. T.R.Banga, S.C.Sharma, N.K.Agarwal, Industrial Engineering and Management Science, Khanna Publishers.
4. Koontz O'Donnell, Principles of Management, McGraw Hill Publishers.
5. R.C.Gupta, Statistical Quality Control, Khanna Publishers.
6. NVS Raju, Industrial Engineering and Management, Cengage India Private Limited.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_me15/preview
2. https://onlinecourses.nptel.ac.in/noc20_mg43/preview
3. <https://www.edx.org/learn/industrial-engineering>
4. <https://youtube.com/playlist?list=PL299B5CC87110A6E7&si=TghLCbEobuxjEaXi>
5. https://youtube.com/playlist?list=PLbjTnjt5Gkl0z3OHOGK5RB9mvNYvnImW&si=oaX_5RG69hS3v2ll

II B. Tech. – II Semester

(23E00401T) COMPLEX VARIABLES, PROBABILITY AND STATISTICS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	0	0	3

PREREQUISITES: Differentiation & Integration

COURSE OBJECTIVES

- This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables.
- The theory of Probability and random variables.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Analyze limit, continuity and differentiation of functions of complex variables and Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.
- CO2 : Understand Cauchy theorem, Cauchy integral formulas and apply these to evaluate complex contour integrals. Classify singularities and poles; find residues and evaluate complex integrals using the residue theorem.
- CO3 : Apply Probability theory to find the chances of happening of events.
- CO4 : Understand various probability distributions and calculate their statistical constants.
- CO5 : Analyze to test various hypotheses included in theory and types of errors for large samples.

DETAILED SYLLABUS:

UNIT-I: Complex Variable – Differentiation

Introduction to functions of complex variable-concept of Limit & continuity-Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

UNIT-II: Complex Variable – Integration

Line integral-Contour integration, Cauchy's integral theorem(Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

UNIT-III: Probability Theory

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation

UNIT-IV: Random variables & Distributions

Random variables (discrete and continuous), probability density functions, properties, mathematical expectation Probability distribution - Binomial, Poisson approximation to the binomial distribution, Normal distribution and their properties

UNIT-V: Estimation And Testing of Hypothesis, Large Sample Tests

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition
2. Miller and Friends, Probability and Statistics for Engineers, 7/e, Pearson, 2008.

REFERENCE BOOKS:

1. R.K.Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
2. B.V.Ramana, Higher Engineering Mathematics, Mc Graw Hill publishers
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_ma50/preview
2. <https://archive.nptel.ac.in/courses/111/106/111106111/>

CBIT

II B. Tech. – II Semester

(23E03401T) MANUFACTURING PROCESSES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	0	0	3

PREREQUISITES: Basic Mechanical Engineering

COURSE OBJECTIVES

- Know the working principle of different metal casting processes and gating system.
- Classify the welding processes, working of different types of welding processes and welding defects.
- Know the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Understand the principles of forging, tools and dies, working of forging processes.
- Know about the Additive manufacturing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Design the patterns and core boxes for metal casting processes
- CO2 : Understand the different welding processes
- CO3 : Demonstrate the different types of bulk forming processes
- CO4 : Understand sheet metal forming processes
- CO5 : Learn about the different types of additive manufacturing processes

DETAILED SYLLABUS:

UNIT-I: Casting

Casting: Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types of cores, Principles of Gating, Risers, casting design considerations. Methods of melting and types of furnaces, Solidification of castings and casting defects- causes and remedies. Basic principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

UNIT-II: Welding

Welding: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, submerged arc welding, TIG & MIG welding. Electro-slag welding. Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing. Heat affected zones in welding; pre & post heating, welding defects – causes and remedies.

UNIT-III: Bulk Forming

Bulk Forming: Plastic deformation in metals and alloys-recovery, recrystallization and grain growth. Hot working and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging-Types of Forging, forging defects and remedies; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing

UNIT-IV: Random Variables & Distributions

Sheet metal forming- Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools.

High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

UNIT-V: Additive Manufacturing

Additive manufacturing - Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, VAT photo polymerization AM Processes, Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications.

TEXTBOOKS:

1. Kalpakjain S and Steven R Schmid, Manufacturing Processes for Engineering Materials, 5/e, Pearson Publications, 2007.
2. P.N. Rao, Manufacturing Technology -Vol I, 5/e, McGraw Hill Education, 2018.

REFERENCE BOOKS:

1. A.Ghosh & A.K.Malik, Manufacturing Science, East West Press Pvt. Ltd, 2010.
2. Lindberg and Roy, Processes and materials of manufacture, 4/e, Prentice Hall India Learning Private Limited, 1990.
3. R.K. Jain, Production Technology, Khanna Publishers, 2022.
4. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
5. H.S. Shaun, Manufacturing Processes, 1/e, Pearson Publishers, 2012.
6. WAJ Chapman, Workshop Technology, 5/e, CBS Publishers & Distributors Pvt.Ltd, 2001.
7. Hindustan Machine Tools, Production Technology, Tata McGraw Hill Publishers, 2017.
8. Ian Gibson, David W Rosen, Brent Stucker., Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, 2/e, Springer, 2015.

ONLINE LEARNING RESOURCES:

1. <https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes>
2. https://onlinecourses.nptel.ac.in/noc21_me81/preview
3. www.coursera.org/learn/introduction-to-additive-manufacturing-processessera
4. <https://archive.nptel.ac.in/courses/112/103/112103263/>
5. <https://archive.nptel.ac.in/courses/112/107/112107250/>
6. <https://nptel.ac.in/courses/112106153>
7. <https://nptel.ac.in/courses/112107144>

II B. Tech. – II Semester

(23E03402T) FLUID MECHANICS AND HYDRAULIC MACHINES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	0	0	3

PREREQUISITES: Physics, Basic Mechanical Engineering

COURSE OBJECTIVES

- Understand the properties of fluids, manometry, hydrostatic forces acting on different surfaces
- Understand the kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations.
- Understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Understand the basic concepts of fluid properties.
 CO2 : Estimate the mechanics of fluids in static and dynamic conditions.
 CO3 : Apply the Boundary layer theory, flow separation and dimensional analysis.
 CO4 : Estimate the hydro dynamic forces of jet on vanes in different positions.
 CO5 : Understand the working Principles and performance evaluation of hydraulic pump and turbines.

DETAILED SYLLABUS:

UNIT-I: Fluid statics & Buoyancy And floatation

Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapour pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of meta center height. Stability analysis and applications.

UNIT-II: Fluid Kinematics & Fluid dynamics:

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flownet, source and sink, doublet and vortex flow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a streamline, momentum equation and its applications, force on pipe bend.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel – total energy line – hydraulic gradient line

UNIT-III: Boundary Layer Theory & Dimensional Analysis

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

UNIT-IV: Basics of Turbo Machinery & Hydraulic Turbines

Basics of turbo machinery: hydrodynamic force of jets on and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow Over radial vanes.

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design draft tube-theory-functions and efficiency.

UNIT-V: Performance of Hydraulic Turbines & Centrifugal Pumps

Performance of Hydraulic Turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

Centrifugal Pumps: classification, working, work done – manometric head- losses and efficiencies-specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Reciprocating Pumps: Working, Discharge, slip, indicator diagrams.

TEXTBOOKS:

1. Y.A.Cengel, J.M.Cimbala, Fluid Mechanics, Fundamentals and Applications, 6/e, Mc Graw Hill Publications, 2019.
2. Dixon, Fluid Mechanics and Thermodynamics of Turbomachinery, 7/e, Elsevier Publishers, 2014.

REFERENCE BOOKS:

1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. RK Bansal, Fluid Mechanics and Hydraulic Machines, 10/e, Laxmi Publications (P) Ltd, 2019.
3. Rajput, Fluid Mechanics and Hydraulic Machines, S Chand & Company, 2016.
4. D.S.Kumar, Fluid Mechanics and Fluid Power Engineering, S K Kataria & Sons, 2013.
5. D.Rama Durgaiah, Fluid Mechanics and Machinery, 1/e, New Age International, 2002.

ONLINE LEARNING RESOURCES:

1. <https://archive.nptel.ac.in/courses/112/105/112105206/>
2. <https://archive.nptel.ac.in/courses/112/104/112104118/>
3. <https://www.edx.org/learn/fluid-mechanics>
4. https://onlinecourses.nptel.ac.in/noc20_ce30/previewnptel.ac.in
5. www.coursera.org/learn/fluid-powerera

II B. Tech. – II Semester

(23E03403T) THEORY OF MACHINES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	0	0	3

PREREQUISITES: Engineering Mechanics

COURSE OBJECTIVES

- Introduce various basic mechanisms and their applications.
- Explain importance of degree of freedom.
- Familiarize velocity and acceleration in mechanisms.
- Describe the cams and follower motions.
- Explain the importance of gyroscopic couples.
- Introduce the equation of motion for single degree of freedom system.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Understand different mechanisms and their inversions.
CO2 : Calculate velocity and acceleration of different links in a mechanism
CO3 : Apply the effects of gyroscopic couple in ships, aero planes and road vehicles.
CO4 : Evaluate unbalance mass in rotating machines.
CO5 : Analyze free and forced vibrations of single degree freedom systems.

DETAILED SYLLABUS:

UNIT-I: Simple Mechanisms

Simple Mechanisms: Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains- Limit positions – Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line mechanisms – Universal Joint – Rocker mechanisms.

UNIT-II: Plane And Motion Analysis

Plane and motion analysis: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations – kinematic analysis of simple mechanisms – slider crank mechanism dynamics – Coincident points – Coriolis component of acceleration.

UNIT-III: Balancing of Rotating masses & Cams

Gyroscope: Principle of gyroscope, gyroscopic effect in an aeroplane, ship, car and two wheeler, simple problems

Gear Profile: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

UNIT-IV: Balancing of Rotating Masses & Cams

Balancing of Rotating Masses: Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

Cams: Classification of cams and followers- Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – derivatives of follower motions- specified contour cams- circular and tangent cams – pressure angle and undercutting

UNIT-V: Vibrations

Vibrations: Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.

Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design, fly wheels for punching press.

TEXTBOOKS:

1. S.S.Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

REFERENCE BOOKS:

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J.:Prentice Hall, 1993.

ONLINE LEARNING RESOURCES:

1. <https://nptel.ac.in/courses/112104114>
2. <https://nptel.ac.in/courses/112101096>
3. https://archive.org/details/NPTEL-MechEngr-Dynamics_of_Machines
4. <https://www.youtube.com/watch?v=OIZXxPVpmBs>
5. <https://www.digimat.in/nptel/courses/video/112104114/L01.html>

CBIT

II B. Tech. – II Semester

(23E03402L) FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	0	0	9	1.5

PREREQUISITES: Physics Basic Mechanical Engineering

COURSE OBJECTIVES

- To impart practical exposure on the performance valuation methods of various flow measuring equipment and hydraulic turbines and pumps.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Demonstrate the devices used for measuring flow.
CO2 : Compute major losses in pipes.
CO3 : Illustrate the operating parameters of turbines.
CO4 : Explain the working of different types of pumps.
CO5 : Explain the devices used for measuring flow.

DETAILED SYLLABUS:

LIST OF EXPERIMENTS

- Impact of jets on Vanes.
- Performance Test on Pelton Wheel.
- Performance Test on Francis Turbine.
- Performance Test on Kaplan Turbine.
- Performance Test on Single Stage Centrifugal Pump.
- Performance Test on Multi Stage Centrifugal Pump.
- Performance Test on Reciprocating Pump.
- Calibration of Venturimeter.
- Calibration of Orificemeter.
- Determination of friction factor for a given pipeline.
- Determination of loss of head due to sudden contraction in a pipeline.
- Turbine flow meter.

Virtual Lab:

- To study different patterns of a flow through a pipe and correlate them with the Reynolds number of the flow.
(<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/introduction.html>)
- To calculate Total Energy at different points of venturimeter.
(<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/introduction.html>).
- To calculate the flow (or point) velocity at center of the given tube using different flow rates.
(<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/pitot/introduction.html>)
- To determine the hydrostatic force on a plane surface under partial submerge and full submerge condition.
(<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/cop/introduction.html>).
- To determine the discharge coefficient of a triangular notch.
(<https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/introduction.html>)
- To determine the coefficient of impact of jet on vanes.
(<https://fm-nitk.vlabs.ac.in/exp/impact-of-jet>).
- To determine friction in pipes.
(<https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/index.html>).

II B. Tech. – II Semester

(23E03401L) MANUFACTURING PROCESSES LAB

Int. Marks	Ext. Marks	Total Marks
30	70	100

L	T	P	C
0	0	9	1.5

PREREQUISITES: Engineering Workshop

COURSE OBJECTIVES

- Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Make moulds for sand casting.
CO2 : Fabricate different types of components using various manufacturing techniques.
CO3 : Adapt unconventional manufacturing methods.
CO4 : Develop Different Weld joints.
CO5 : Explain different types of 3d Printing techniques.

DETAILED SYLLABUS:

LIST OF EXPERIMENTS

1. Design and making of pattern
i. Single piece ii. Pattern iii. Split pattern
2. Sand properties testing
i. Sieve analysis(dry sand) ii. Clay content test iii. Moisture content test
iv. Strength test (Compression test & Shear test) v. Permeability test
3. Mould preparation
i. Straight pipe ii. Bent pipe iii. Dumble iv. Gearblank
4. Gas cutting and welding
5. Manual metal arc welding
i. Lap joint ii. Butt joint
6. Injection Molding
7. Blow Molding
8. Simple models using sheet metal operations
9. Study of deep drawing and extrusion operations
10. To make weldments using TIG/MIG welding
11. To weld using Spot welding machine
12. To join using Brazing and Soldering
13. To make simple parts on a 3D printing machine
14. Demonstration of metal casting.

Virtual Lab:

1. study and observe various stages of casting through demonstration of casting process.
(<https://virtual-labs.github.io/exp-sand-casting-process-dei/theory.html>)
2. To weld and cut metals using an oxyacetylene welding setup.
(<https://virtual-labs.github.io/exp-gas-cutting-processes-iitkgp/index.html>).
3. To simulate Fused deposition modelling process (FDM)
(<https://3dpdei.vlabs.ac.in/exp/simulation-modelling-process>)
4. <https://altair.com/inspire-mold/>
5. <https://virtual-labs.github.io/exp-simulation-cartesian-system-dei/theory.html>

II B. Tech. – II Semester

(23E00406SC) SOFT SKILLS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	0	1	2	2

PREREQUISITES:

COURSE OBJECTIVES

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To enhance healthy relationship and understanding within and outside an organization
- To function effectively with heterogeneous teams

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1 : Memorize various elements of effective communication skills
CO2 : Interpret people at the emotional level through emotional intelligence
CO3 : Explain impact of business in present scenario
CO4 : Develop the accounting statements and evaluate the financial performance of Business entity
CO5 : Analyze how to invest their capital and maximize returns

DETAILED SYLLABUS:

UNIT-I: Soft Skills & Communication Skills

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques.

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity.

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches-convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.

UNIT-II: Critical Thinking

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis.

UNIT-III: Problem Solving & Decision Making

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles.

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion

UNIT-IV: Emotional Intelligence & Stress Management

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips.

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress -ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT V: Leadership Skills

Team-Building - Decision-Making - Accountability - Planning - Public Speaking - Motivation - Risk Taking - Team Building - Time Management

Activities

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice - sense of adjustment - vision - accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Spcaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

NOTE:-

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.

PRESCRIBED BOOKS:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018

REFERENCE BOOKS:

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand& Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018..
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: NotionPress
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher :Vayu Education of India, 2014

Online Learning Resources:

1. https://youtu.be/DUIsNJtg2L8?list=PLLy_2iUCG87CQhELCYtvXh0E_y-b001_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHIsQFwJZel_j2PUy0pwjVUgj7KIJ
3. <https://youtu.be/-Y-R9hDI7IU>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>
6. <https://youtu.be/FchfE3c2jzc>
7. <https://www.businessstrainingworks.com/training-resource/five-free-business-etiquette-training-games/>
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

II B. Tech. – II Semester

(23E00404MC) DESIGN THINKING FOR NOVATION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	1	0	2	2

PREREQUISITES:

COURSE OBJECTIVES

- To explain the basic knowledge and evolution of design thinking
- To familiarize the students with design thinking process as a tool for break through innovation
- To give an overview on creativity and innovation in organizations
- To explain various innovations towards product design

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- C01 : Define the concepts related to design thinking.
C02 : Explain the fundamentals of Design Thinking and innovation
C03 : Apply the design thinking techniques for solving problems in various sectors.
C04 : Analyse to work in a multidisciplinary environment
C05 : Formulate specific problem statements of real time issues

DETAILED SYLLABUS:

UNIT I: Introduction To Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT II: Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III: Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT IV: Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT V: Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

TEXTBOOKS:

1. Tim Brown, Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

REFERENCE BOOKS:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shruti N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

ONLINE LEARNING RESOURCES:

1. <https://nptel.ac.in/courses/110/106/110106124/>
2. <https://nptel.ac.in/courses/109/104/109104109/>
3. https://swayam.gov.in/nd1_noc19_mg60/preview

CBIT

COMMUNITY SERVICE PROJECT

.....Experiential learning through community engagement

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible Institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the

college.

- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
- First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, It could be another primary source of data.
- Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
 - Agriculture
 - Health
 - Marketing and Cooperation
 - Animal Husbandry
 - Horticulture
 - Fisheries
 - Sericultur
 - Revenue and Survey
 - Natural Disaster Management
 - Irrigation
 - Law & Order
 - Excise and Prohibition
 - Mines and Geology
 - Energy
 - Internet
 - Free Electricity
 - Drinking Water

EXPECTED OUTCOMES BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and

- career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following is the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution

17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Flourey culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social
6. Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath



7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days Programs for Youth

Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality

Development Common Programs

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
 - i. Agriculture
 - ii. Health
 - iii. Marketing and Cooperation
 - iv. Animal Husbandry
 - v. Horticulture
 - vi. Fisheries
 - vii. Sericulture
 - viii. Revenue and Survey
 - ix. Natural Disaster Management
 - x. Irrigation
 - xi. Law & Order
 - xii. Excise and Prohibition
 - xiii. Mines and Geology
 - xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity Duration: 8 weeks

1. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

2. Community Awareness Campaigns (One Week)

Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Programme (Three Weeks)

Along with the Community Awareness Programmes, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

