ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)
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B.Tech. –Mechanical Engineering　　　　　　　　　　　　　　*HM23 Regulations*

B.TECH.-MECHANICAL ENGINEERING
II YEAR COURSE STRUCTURE & SYLLABI

B.Tech.– II Year I Semester

S.No.	Course code	Title	L	T	P	Credits
1	23HBS9911	Numerical Methods &Transform Techniques	3	0	0	3
2	23HHS9901	Universal Human Values– Understanding Harmony& Ethical human conduct	2	1	0	3
3	23HES0303	Thermodynamics	2	0	0	2
4	23HPC0303	Mechanics of Solids	3	0	0	3
5	23HPC0304	Material Science and Metallurgy	3	0	0	3
6	23HPC0305	Mechanics of Solids and Materials Science Lab	0	0	3	1.5
7	23HPC0306	Computer-Aided Machine Drawing	0	0	3	1.5
8	23HSC0401	Embedded Systems and IoT	0	0	2	1.0
9	23HES0505	Python programming	0	1	2	2
10	23HAC9901	Environmental Science	2	0	0	-
		Total	**15**	**2**	**10**	**20**

B.Tech. II Year II Semester

S.No.	Course code	Title	L	T	P	Credits
1	23HM1E02	Industrial Management	2	0	0	2
2	23HBS9914	Complex Variables, Probability and Statistics	3	0	0	3
3	23HPC0307	Manufacturing processes	3	0	0	3
4	23HPC0308	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	23HPC0309	Theory of Machines	3	0	0	3
6	23HPC0310	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	23HPC0311	Manufacturing processes Lab	0	0	3	1.5
8	23HSC1E01	Soft Skills	0	1	2	2
9	23HBS9916	Design Thinking & Innovation	1	0	2	2
		Total	**15**	**1**	**10**	**21**
	Mandatory Community Service Project Internship of 08weeks duration during summer Vacation					

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineering
YSR Engineering College of YVU
PRODDATUR 516 360

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B.Tech. II Year – I Semester	NUMERICAL METHODS AND TRANSFORM TECHNIQUES (For MECH)	L	T	P	C
		3	0	0	3

Course Outcomes:
After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Apply numerical methods to solve algebraic and transcendental equations	L2, L3
CO2	Derive interpolating polynomials using interpolation formulae	L3, L5
CO3	Solve differential and integral equations numerically	L3
CO4	Understand the use of Laplace transform in system modeling, digital signal processing, process control, solving Boundary Value Problems.	L2, L3
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.	L3, L5

UNITI: **Solution of Algebraic & Transcendental Equations**
Introduction - Bisection Method, Regula-falsi method and Newton-Raphson method.
Solution to system of Nonlinear equations: The method of iteration and Newton -Raphson 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&Fourier transforms**
Fourier series: Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence ofFourier 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.

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Textbooks:
1. S. S.Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.
2. B.S.Grewal,HigherEngineeringMathematics, KhannaPublishers,2017, 44th Edition.

ReferenceBooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India
2. R.K.Jain andS.R.K.Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. B.V.Ramana, Higher Engineering Mathematics, McGraw Hill publishers
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. https://nptel.ac.in/courses/111105090

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II Year B.Tech. ME – I Semester

L	T	P	C
2	1	0	3

(23A52301) UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT
(Common to All Branches of Engineering)

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: At the end of the course, students will be able to		Blooms Level
CO1	Define the terms like Natural Acceptance, Happiness and Prosperity	L1, L2
CO2	Identify one's self, and one's surroundings (family, society nature)	L1, L2
CO3	Apply what they have learnt to their own self in different day-to-day settings in real life	L3
CO4	Relate human values with human relationship and human society.	L4
CO5	Justify the need for universal human values and harmonious existence	L5
CO6	Develop as socially and ecologically responsible engineers	L3, L6

Course Topics

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

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

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

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education

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Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II   Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III   Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV   Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

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

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

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READINGS:

Textbook and Teachers Manual

a. The Textbook

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

b. The Teacher's Manual

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

Reference Books

1. 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%202023.pdf

5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf

6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf

7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf

8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385

https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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B.Tech. –Mechanical Engineering   *HM23 Regulations*

II Year B.Tech. ME – I Semester

L	T	P	C
2	0	0	2

(23HES0303) THERMODYNAMICS

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:

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

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

Unit -II
Energy in State and in Transition, Types, Work and Heat, Point and Path function. 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.

M. Rami   Dr. G. JAYACHANDRA REDDY
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Unit - III

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

Unit - IV

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

Unit – V

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

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

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

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II Year B.Tech. ME – I Semester

L	T	P	C
3	0	0	3

(23HPC0303) MECHANICS OF SOLIDS

Course Objectives: The objectives of the course are to
- Understand the behaviour of basic structural members subjected to uniaxial and bi axial loads.
- Apply the concept of stress and strain to analyse and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
- Students will learn all the methods to analyse beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural component Students are able to analyse beam sand 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:

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

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

UNIT–II

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

UNIT–III

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

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

UNIT–IV

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, UDL and UVL. Mohr's theorem and Moment area method – application to simple cases.

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

UNIT– V

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

COLUMNS:

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

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

M. Ramu

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B.Tech. –Mechanical Engineering   *HM23 Regulations*

Reference Books:

1. Gere &Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.

2. U.C. Jindal, Strength of Materials, 2/e, Pearson Education, 2017.

3. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.

4. Andrew Pytel and Ferdinand L. Singer, Strength of Materials,4/e, Longman Publications, 1990.

5. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Online Learning Resources:

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

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II Year B.Tech. ME – I Semester

L	T	P	C
3	0	0	3

(23HPC0304) MATERIAL SCIENCE & METALLURGY

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

Course Outcomes:

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

UNIT– I

Structure of Metals and Constitution of alloys: Crystallization of metals, Packing Factor - SC, BCC, FCC& HCP-line density, plane density. Grain and grain boundaries, effect of grain boundaries–determination of grain size. Imperfections, Slip and Twinning.
Necessity of alloying, types of Solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, 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-Fe$_3$C.

M. Rami
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Professor of Mechanical Engineeing
YSR Engineering College of YVU
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UNIT–II

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

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

UNIT–III

Heat treatment of Steels: Effect of alloying elements on Fe-Fe$_3$C system, annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, age hardening treatment, Cryogenic treatment.

UNIT–IV

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

UNIT– V

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

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

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

Online Learning Resources:
- https://archive.nptel.ac.in/courses/113/106/113106032/
- https://www.youtube.com/watch?v=9Sf278j1GTU
- https://www.coursera.org/learn/fundamentals-of-materials-science
- https://www.coursera.org/learn/material-behavior.

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineering
YSR Engineerng College of YVU
PRODDATUR 516 360

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B.Tech. –Mechanical Engineering   *HM23 Regulations*

II Year B.Tech. ME – I Semester

L	T	P	C
0	0	3	1.5

(23HPC0305) MECHANICS OF SOLIDS & MATERIAL SCIENCE LAB

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

Course Outcomes:

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

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

A) MECHANICSOFSOLIDSLAB:
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

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineeing
YSR Engineering College of YVU
PRODDATUR 516 360

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B.Tech. –Mechanical Engineering   *HM23 Regulations*

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).

M. Ramu

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineering
YSR Engineering College of YVU
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II Year B.Tech. ME – I Semester

L	T	P	C
0	0	3	1.5

(23HPC0306) COMPUTER-AIDED MACHINE DRAWING

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:

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

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

Conventional representation of materials and components:
Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.
Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.
Welded joints: Lap joint and T joint with fillet, butt joint with conventions.
Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.
Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldham's' coupling.

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

Sectional views:
Creating solid models of complex machine parts and sectional views.

Assembly drawings:(Any four of the following using solid model software)
Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling.

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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 byK.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:

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

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineering
YSR Engineering College of YVU
PRODDATUR 516 360

II Year B.Tech. ME – I Semester

L	T	P	C
0	0	2	1

(23A03306) EMBEDDED SYSTEMS & IoT

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

Course Outcomes:

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

Embedded Systems Experiments: (Any 5 experiments from the following)
1. Measure Analog signal from Temperature Sensor.
2. Generate PWM output.
3. Drive single character generation on Hyper Terminal.
4. Drive a given string on Hyper Terminal.
5. Full duplex Link establishment using Hyper terminal.
6. Drive a given value on a 8 bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on Hyper Terminal.
COMPONENTS/ BOARDS: 1. Arduino Duemilanove Board 2. Arduino Software IDE.

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

Internet of Things Experiments: (Any 5 experiments from the following)
1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace
3. and debug Python code on the device.
4. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.
5. Raspberry Pi interact with online services through the use of public APIs and SDKs.
6. Study and Install IDE of Arduino and different types of Arduino.
7. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
8. Calculate the distance using distance sensor Using Arduino.
9. Basic LED functionality Using Arduino and Node MCU.
10. Calculate the moisture content in the soil using Arduino and Node MCU.
11. Calculate the distance using distance sensor Using Node MCU.
12. Basic LED functionality Using Node MCU.

Prof. K.Venkata Ramanaiai
Dean Faculty of Engineering
Y.S.R. Engineering College of Y
Korrapadu Road, PRODDATUR-51630-

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II Year B.Tech. – I Semester

L	T	P	C
0	1	2	2

(23HSC0502) PYTHON PROGRAMMING

Course Objectives: The main objectives of the course are to
- 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 completion of the course, students will be able to
- Showcase adept command of Python syntax, deftly utilizing variables, data types, control structures, functions, modules, and exception handling to engineer robust and efficient code solutions. (L4)
- Apply Python programming concepts to solve a variety of computational problems (L3)
- 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 (L3)
- Proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
- Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)

UNTI-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 membersand 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 itemsin 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.
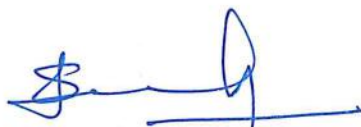
Sample Experiments:

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.
31. To perform element wise operations(addition,multiplication) on two arrays by using numpy package in python.
32. To merge two data frames based on a common column in python.

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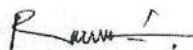
1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson,2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

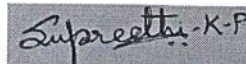### Online Learning Resources/Virtual Labs:

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

Signatures
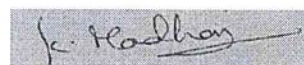
Chairman (HOD of CSE)
(Dr. C.VENKATA SUBBAIAH)

Academic council
(Dr. T.RAMAKRISHNUDU)

Academic council
(Dr. K.P.SUPREETHI)

University nominee
(Dr. K.MADHAVI)

Internal member
(Mrs. K.MUNNI)

Internal member
(Mrs. J.SANDHYA RANI)

II Year B.Tech. – I Semester

L	T	P	C
2	0	0	0

(23HAC9901) ENVIRONMENTAL SCIENCE

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

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

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

UNIT II
Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:
    a. Forest ecosystem.
    b. Grassland ecosystem
    c. Desert ecosystem.
    d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation : Introduction 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-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III
Environmental Pollution: Definition, Cause, effects and control measures of :
    a. Air Pollution.
    b. Water pollution
    c. Soil pollution
    d. Marine pollution
    e. Noise pollution
    f. Thermal pollution
    g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes –

Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

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

UNIT V
Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.
Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Textbooks:
1. 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", Prentice hall 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.

II SEM

II Year B.Tech. ME – II Semester

L	T	P	C
2	0	0	2

(23HMC1E02) INDUSTRIAL MANAGEMENT

Course Objectives: The objectives of the course are to
- 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:

COs	Statements	Blooms Level
CO1	Learn about how to design the optimal layout	L1
CO2	Demonstrate work study methods	L3
CO3	Explain Quality Control techniques	L2
CO4	Discuss the financial management aspects	L3
CO5	Understand the human resource management methods.	L2

UNIT– I
INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, quantitative tools of IE and productivity measurement. Concepts of management, importance, functions of management, scientific management, Taylor's principles, Fayol's principles of management.

PLANTLAYOUT: 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: 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: 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.

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UNIT– IV

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

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

ReferenceBooks:

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,IndustrialEngineeringandManagementScience, 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 Sources

- https://onlinecourses.nptel.ac.in/noc21_me15/preview
- https://onlinecourses.nptel.ac.in/noc20_mg43/preview
- https://www.edx.org/learn/industrial-engineering
- https://youtube.com/playlist?list=PL299B5CC87110A6E7&si=TghLCbEobuxjEaXi
- https://youtube.com/playlist?list=PLbjTnj-t5Gkl0z3OHOGK5RB9mvNYvnImW&si=oaX_5RG69hS3v2ll

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineering
YSR Engineering College of YVU
PRODDATUR 516 360

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B.Tech. II Year - II Semester	(23HBS9914) COMPLEX VARIABLES, PROBABILITY AND STATISTICS (For MECH)	L	T	P	C
		3	0	0	3

Course Outcomes:
After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Analyze limit, continuity and differentiation of functions of complex variables and Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.	L2, L3
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.	L3, L5
CO3	Apply Probability theory to find the chances of happening of events.	L2, L3
CO4	Understand various probability distributions and calculate their statistical constants.	L3, L5
CO5	To identify real life problems into Mathematical Models.	L2, L3

UNITI: 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 and Random variables
Probability: Sample space and events, axioms of probability, some elementary theorems (addition and multiplicative law) of probability, conditional probability, Bayes' Theorem.
Random variables: Introduction, discrete and continuous, probability density functions, properties, mathematical expectation.

UNITIV: Probability Distributions
Probability distribution - Binomial, Poisson distributions, Poisson approximation to the binomial distribution, Normal distribution and their properties, Uniform and Exponential distributions.

UNITV: 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

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

ReferenceBooks:
1. R.K.JainandS.R.K.Iyengar,AdvancedEngineeringMathematics,AlphaScienceInternationalLtd., 2021 5thEdition(9th reprint).
2. B.V.Ramana, Higher Engineering Mathematics, McGraw 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.

II Year B.Tech. ME – II Semester

L	T	P	C
3	0	0	3

(23HPC0307) MANUFACTURING PROCESSES

Course Objective: The objectives of the course are to
- 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:

COs	Statements	Blooms Level
CO1	Design the patterns and core boxes for metal casting processes	L6
CO2	Understand the different welding processes	L2
CO3	Demonstrate the different types of bulk forming processes	L3
CO4	Understand sheet metal forming processes	L2
CO5	Learn about the different types of additive manufacturing processes	L2

UNIT– I
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: 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.

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UNIT–III

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

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

Textbooks:
1. Kalpak jain 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.
7. Hindustan Machine Tools, Production Technology, Tata McGraw Hill Publishers.
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:
- https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes
- https://onlinecourses.nptel.ac.in/noc21_me81/preview
- www.coursera.org/learn/introduction-to-additive-manufacturing-processessera

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineeing
YSR Engineering College of YVU
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II Year B.Tech. ME – II Semester

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3	0	0	3

(23HPC0308) FLUID MECHANICS & HYDRAULIC MACHINES

Course Objectives: The students completing this course are expected to
- 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:

COs	Statements	Blooms Level
CO1	Understand the basic concepts of fluid properties.	L2
CO2	Estimate the mechanics of fluids in static and dynamic conditions.	L5
CO3	Apply the Boundary layer theory, flow separation and dimensional analysis.	L3
CO4	Estimate the hydrodynamic forces of jet on vanes in different positions.	L5
CO5	Understand the working Principles and performance evaluation of hydraulic pump and turbines.	L2

UNIT-I
Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor 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: 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, flow net, 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.

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UNIT-III

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: hydrodynamic force of jets on stationary 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.

UNITV

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, McGraw Hill Publications, 2019.
2. Dixon, Fluid Mechanics and Thermodynamics of Turbomachinery,7/e, Elsevier Publishers, 2014.

ReferenceBooks:
1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. RKBansal, 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:
- https://archive.nptel.ac.in/courses/112/105/112105206/
- https://archive.nptel.ac.in/courses/112/104/112104118/
- https://www.edx.org/learn/fluid-mechanics
- https://onlinecourses.nptel.ac.in/noc20_ce30/previewnptel.ac.in
- www.coursera.org/learn/fluid-powerera

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineering
YSR Engineering College of YVU
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II Year B.Tech. ME – II Semester

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3	0	0	3

(23HPC0309) THEORY OF MACHINES

Course Objectives: The objectives of the course are to make the students learn about
- 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:

COs	Statements	Blooms Level
CO1	Understand different mechanisms and their inversions.	L2
CO2	Calculate velocity and acceleration of different links in a mechanism	L4
CO3	Apply the effects of gyroscopic couple in ships, aero planes and road vehicles.	L3
CO4	Evaluate unbalance mass in rotating machines.	L5
CO5	Analyze free and forced vibrations of single degree freedom systems.	L4

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: Gyroscope & Gear Profile
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.

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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 & Turning Moment Diagrams and Flywheels

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.

M. Rami

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineering
YSR Engineerng College of YVU
PRODDATUR 516 360

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L	T	P	C
0	0	3	1.5

(23HPC0310) FLUID MECHANICS & HYDRAULIC MACHINERY LAB

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Demonstrate the devices used for measuring flow.	L3
CO2	Compute major losses in pipes.	L5
CO3	Illustrate the operating parameters of turbines.	L2
CO4	Explain the working of different types of pumps.	L2
CO5	Explain the devices used for measuring flow.	L2

List of Experiments

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Teston Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orificemeter.
10. Determination of friction factor for a given pipeline.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flowmeter.

Virtual Lab:

1. 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)
2. To calculate Total Energy at different points of venture meter. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/introduction.html).
3. 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)
4. 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).
5. To determine the discharge coefficient of a triangular notch. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/introduction.html)
6. To determine the coefficient of impact of jet on vanes. (https://fm- nitk.vlabs.ac.in/exp/impact-of-jet).
7. To determine friction in pipes. (https://fm-nitk.vlabs.ac.in/exp/friction-in- pipes/index.html).

M. Rami Reddy

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineering
YSR Engineerng College of YVU
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L	T	P	C
0	0	3	1.5

(23HPC0311) MANUFACTURING PROCESSES LAB

Course Objective: Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Make moulds for sand casting.	L2
CO2	Fabricate different types of components using various manufacturing techniques.	L5
CO3	Adapt unconventional manufacturing methods.	L3
CO4	Develop Different Weld joints.	L6
CO5	Explain different types of 3d Printing techniques.	L2

List of Experiments

1. Design and making of pattern
   i. Single piece pattern
   ii. 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. Gear blank
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.

M. Ramu Devans

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineering
YSR Engineering College of YVU
PRODDATUR 516 360

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Virtual Lab:

1. To 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

M. Ramu

Dr. G. JAYACHANDRA REDDY
Professor of Mechanical Engineeing
YSR Engineenng College of YVU
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II Year B.Tech. – II Semester

L	T	P	C
0	1	2	2

(23HSC1E01)SOFT SKILLS

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
- List out various elements of soft skills (L1, L2)
- Describe methods for building professional image (L1, L2)
- Apply critical thinking skills in problem solving (L3)
- Analyse the needs of an individual and team for well-being (L4)
- Assess the situation and take necessary decisions (L5)
- Create a productive workplace atmosphere using social and work-life skills ensuring personal and emotional well-being (L6)

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   Corporate Etiquette

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette - Corporate grooming tips -Overcoming challenges

Activities

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

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: Notion Press
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/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc
7. https://www.businesstrainingworks.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 Year B.Tech. – II Semester

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(23BS9916) DESIGN THINKING & INNOVATION

Course Objectives:
The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes:
- Define the concepts related to design thinking. (L1, L2)
- Explain the fundamentals of Design Thinking and innovation (L1, L2)
- Apply the design thinking techniques for solving problems in various sectors. (L3)
- Analyse to work in a multidisciplinary environment (L4)
- Evaluate the value of creativity (L5)
- Formulate specific problem statements of real time issues (L3, L6)

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. Shrutin 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:
https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

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
    - Sericulture
    - 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 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. Floury 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 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.

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Timeline for the Community Service Project Activity
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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 secreteriats 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.