INSTITUTE VISION:

To emerge as a centre of excellence in technical education by imparting quality teaching learning practices and research for the transformation of society.

INSTITUTE MISSION:

- Provide an ideal and the best class infrastructure to foster exploration in engineering and research.
- Build dedicated faculty with student centric teaching incorporating experiential, innovative skills.
- Encourage lifelong learning, entrepreneurial thinking and ethical responsibility in students to address societal challenges.

DEPARTMENT VISION:

To impart quality education in the field of Mechanical Engineering to meet the industrial standards and technological needs of the society.

DEPARTMENT MISSION

1. To provide quality education for career building and skill enhancement and to become globally competitive.
2. To groom the students with leadership qualities, problem solving approach, along with team work and effective communication.

PROGRAM EDUCATIONAL OUTCOMES (PEOs)

PEO No	Program Educational Objectives Statements
PEO 1	To train the graduates in building a successful professional career in Mechanical Engineering.
PEO 2	To encourage the graduate engineers to achieve their goals through higher education and Research & Development activities.
PEO 3	To support the graduates to become moral & ethically responsible citizens in the development of the nation.

Program Outcomes (PO)

Engineering Graduates will be able to:

PO1. Engineering knowledge: Apply the knowledge of mathematics, natural science, computing engineering fundamentals, and an engineering specialization as specified in WK1 TO WK4 respectively to develop to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3. Design/development of solutions: Design creative solutions for complex engineering problems and design/develop systems/ components/ processes to meet identified needs with consideration for the public health and safety, whole – life cost, net zero carbon, culture, society and environment as required.

PO4. Conduct investigations of complex problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis and interpretation of data to provide valid conclusions.

PO5. Engineering tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling recognizing their limitations to solve complex engineering problems.

PO6. The engineer and the world: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal frame work, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national and international law.

PO8. Individual and collaborative team work: Function effectively as an individual, and as a member or leader in diverse / multidisciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language and learning differences.

PO10: Project management and finance: Apply knowledge and understanding of the engineering management principles and economic decision making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-long learning: Recognize the need for, and have the preparation and ability for i) independent and lifelong learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSOs)

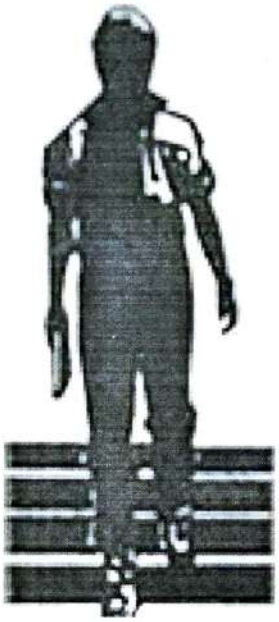
PSO1	Apply Engineering fundamental knowledge, complex mathematics, science and provide solutions to mechanical Engineering system
PSO2	Design and develop products innovatively with modern tools and to optimize manufacturing processes

COURSE STRUCTURE & SYLLABUS - *II YEAR*

MECHANICAL ENGINEERING

(Applicable for batches admitted from 2023-24)

UR-23



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Ch. Sastri Rao

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COURSE STRUCTURE & SYLLABUS - *II YEAR*

MECHANICAL ENGINEERING

(Applicable for batches admitted from 2023-24)

UR-23

[APPROVED IN BOS MEETING HELD ON 23-05-2024]

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COURSE STRUCTURE
MECHANICAL ENGINEERING
(Applicable for batches admitted from 2023-24)

I SEMESTER(I YEAR- I SEMESTER)								
S. No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Contact Hrs/Wk**	**C**
1	BS&H	23BS101B	Engineering Physics	3	0	0	3	3
2	BS&H	23BS103	Linear Algebra & Calculus	3	0	0	3	3
3	ES	23ES102B	Basic Electrical & Electronics Engineering	3	0	0	3	3
4	ES	23ES105B	Engineering Graphics	1	0	4	5	3
5	PC	23PC104C	Engineering Mechanics	3	0	0	3	3
6	ES	23ES113B	IT Workshop	0	0	2	2	1.0
7	BS&H	23BS111B	Engineering Physics Lab	0	0	2	2	1.0
8	ES	23ES112B	Electrical & Electronics Engineering Workshop	0	0	3	3	1.5
9	PC	23PC114C	Engineering Mechanics lab	0	0	3	3	1.5
10	BS&H	23BS115A	NSS/NCC/Scouts & Guides/Community Service	-	--	1	1	0.5
TOTAL				**13**	**0**	**15**	**28**	**20.5**

II SEMESTER(I YEAR- II SEMESTER)								
S. No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Contact Hrs/Wk**	**C**
1	BS&H	23BS201A	Communicative English	2	0	0	2	2
2	BS&H	23BS202B	Engineering Chemistry	3	0	0	3	3
3	BS&H	23BS203	Differential Equations & Vector Calculus	3	0	0	3	3
4	ES	23ES205A	Basic Civil & Mechanical Engineering	3	0	0	3	3
5	ES	23ES204A	Introduction to	3	0	0	3	3
6	BS&H	23BS211A	Communicative English	0	0	2	2	1
7	BS&H	23BS212B	Engineering Chemistry lab	0	0	2	2	1
8	ES	23ES213A	Engineering Workshop	0	0	3	3	1.5
9	ES	23ES214A	Computer Programming	0	0	3	3	1.5
10	BS&H	23BS115A	Health and wellness, Yoga and Sports	-	-	1	1	0.5
TOTAL				**14**	**0**	**11**	**25**	**19.5**

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III SEMESTER(II YEAR- I SEMESTER)								
S. No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Contact Hrs/Wk**	**C**
1	BS	23BS201A	Numerical Methods and Transform Techniques	3	0	0	3	3
2	HSC	23HS302	Universal Human Values–Understanding Harmony &	2	1	0	3	3
3	ES	23ES303B	Thermodynamics	2	0	0	2	2
4	PCC	23PCME304	Mechanics of Solids	3	0	0	3	3
5	PCC	23PCME305	Material science and Metallurgy	3	0	0	3	3
6	ES	23ES311	Mechanics of Solids and Materials Science Lab	0	0	3	3	1.5
7	PCC	23PCME314	Computer aided Machine Drawing	0	0	3	3	1.5
8	ES	23ES312	Python programming lab	0	0	2	2	1
9	SEC	23SEC313B	Soft skills lab	0	1	2	3	2
TOTAL				**13**	**2**	**10**	**25**	**20**
MANDATORY COURSE								
10	AC/MC	23MC300	Environmental Science	0	0	0	2	0

IV SEMESTER(II YEAR- II SEMESTER)								
S. No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Contact Hrs/Wk**	**C**
1	HSC	23HM401B	Industrial Management	2	0	0	2	2
2	BS&H	23BS402	Operations Research	3	0	0	3	3
3	PCC	23PCME403	Manufacturing Processes	3	0	0	3	3
4	PCC	23PCME404	Fluid mechanics & Hydraulic Machines	3	0	0	3	3
5	PCC	23PCME405	Design of machine members	3	0	0	3	3
6	PCC	23PCME411	Fluid Mechanics & Hydraulic machines Lab	0	0	3	3	1.5
7	PCC	23PCME412	Manufacturing processes lab	0	0	3	3	1.5
8	SEC	23SEC413B	Embedded Systems and IoT	0	1	2	3	2
9	ES	23BS414	Design Thinking & Innovation	1	0	2	3	2
TOTAL				**15**	**1**	**10**	**26**	**21**
Mandatory community service project internship of 8 weeks duration during summer vacation								

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B.Tech. III Semester **COURSE CODE: UR23BS201A** **L T P C**
3 0 0 3

NUMERICAL METHODS AND TRANSFORM TECHNIQUES

Internal Marks: 30
External Marks: 70

Course Objectives:

To elucidate the different numerical methods to solve nonlinear algebraic equations

To disseminate the use of different numerical techniques for carrying out numerical integration.

To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

UNIT – I: Iterative Methods: Introduction – Solutions of algebraic and transcendental equations: Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method.

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

UNIT – II: Numerical integration, Solution of ordinary differential equations with initial conditions: Trapezoidal rule– Simpson's 1/3rd and 3/8th rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method – Runge - Kutta method (second and fourth order).

UNIT –III: Laplace Transforms: Definition of Laplace transform - Laplace transforms of standard functions – Properties of Laplace Transforms – Shifting theorems–Transforms of derivatives and integrals – Unit step function – Dirac's delta function – Inverse Laplace transforms – Convolution theorem (without proof).

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

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

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

Text Books:

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

Reference Books:

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

Course Outcomes:

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

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B.Tech. III Semester **COURSE CODE: UR23HS302** **L T P C**
2 1 0 3

UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY & ETHICAL HUMAN CONDUCT

Internal Marks: 30
External Marks: 70

Course Objective:

The objective of the course is four fold:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

UNIT – I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:

Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and experiential Validation- as the process for self-exploration - Continuous Happiness and Prosperity- A look at basic Human Aspirations -Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

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UNIT – II

Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

UNIT – III

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

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UNIT – IV

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT – V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b) At the level of society: as mutually enriching institutions and organizations Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

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Text Book:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - 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)

Course Outcomes:

By the end of the course, students are expected to learn

1. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships
2. They would understand human nature in mind.
3. They would have better critical ability.
4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.
6. Holistic understanding of harmony on professional ethics.

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B.Tech. III Semester **COURSE CODE: UR23ES303B** **L T P C**
2 0 0 2

THERMODYNAMICS

Internal Marks: 30
External Marks: 70

Course Objectives:

- To introduce and familiarize with basic concepts of system, properties and cycles.
- To introduce and familiarize the laws of thermodynamics and their applications to various thermodynamic processes and cycles.

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 – Energy in State and in Transition, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – Concept of Temperature — Scales of Temperature, Ideal Gas Scale

UNIT –II

First law of Thermodynamics – Corollaries – First law applied to a Process –to a flow system – Steady Flow Energy Equation. PMM-I, throttling and free expansion processes – deviations from perfect gas model – Vander waals equation of state – compressibility charts – variable specific heats – gas tables. Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance. Fuels –p conventional and unconventional fuels, solid, liquid and gaseous fuels.

UNIT -III

Second Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot

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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 – introduction Third Law of Thermodynamics.

UNIT- IV

Pure Substances: P-V-T, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point– Clausius – Clapeyron Equation steam Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam calorimetry.

UNIT – V

Power Cycles: Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Text Books:

1. Engineering Thermodynamics, PK Nag 4th Edn , TMH.

2. Thermodynamics – An Engineering Approach with student resources DVD – Y.A.Cengel & M.A.Boles , 7th Edn – McGraw-Hill

3. Applied thermodynamics, Onkar Singh – New age international publishers.

Reference Books:

1. Engineering Thermodynamics – Jones & Dugan PHI

2. Thermodynamics – J.P.Holman, McGraw-Hill

3. Basic Engineering Thermodynamics – A.Venkatesh – Universities press.

4. An Introduction to Thermodynamics - Y.V.C.Rao – Universities press.

5. Thermodynamics – W.Z.Black & J.G.Hartley, 3rd Edn Pearson Publ.

6. Engineering Thermodynamics – D.P.Misra, Cengage Publ.

Ch. Sandhya Rani

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7. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ...

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Explain the importance of thermodynamic properties related to conversion of heat energy into work.
2. Apply the Zeroth and First Law of Thermodynamics.
3. Understand the first law of thermodynamics, which is also the energy conservation principle, and should be able to apply to different thermodynamic systems.
4. Understand Second Law of Thermodynamics.
5. Analyze the Mollier charts, T-S and h-s diagrams, Steam calorimetry, Phase Transformations.
6. Evaluate the thermal efficiency, mean effective pressure on Air standard basis.

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B.Tech. III Semester **COURSE CODE: UR23PCME304** **L T P C**

3 0 0 3

MECHANICS OF SOLIDS

Internal Marks: 30
External Marks: 70

Course Objective:

The students completing this course are expected to understand the basic terms like stress, strain, poisons ratio... and different stresses induced in beams, thin cylinders, thick cylinders, columns. Further, the student shall be able to understand the shear stresses in circular shafts.

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- Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

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

UNIT – III

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections –

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Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle 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, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – Torsion of circular shafts: Assumptions- Torsion equation-simple problems.

UNIT – V

Thin 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 – Riveted boiler shells – Thin spherical shells.

Thick Cylinders: –lame's equation – cylinders subjected to inside & outside pressures –compound cylinders.

Text Books:

1. Strength of materials by Bhavikatti, Lakshmi publications.
2. Solid Mechanics, by Popov.
3. Mechanics of Materials by - Ferdinand P Beer, E Russell Johnston,and John T Dewolf.

Reference Books:

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol-III, by S.B.Junnarkar.
4. Strength of Materials by S.Timshenko.
5. Strength of Materials by Andrew Pytel and Ferdinond L. SingerLongman.

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Course outcomes:

Upon successful completion of the course, the students will be able to

1. Calculate the simple and complex stresses, strains and other mechanical properties of materials
2. Analyze the shear forces and bending moments at various sections in various members
3. Estimate and Analyze stresses in beams.
4. Analyze the deflections in beams under various loadings.
5. Estimate and analyze the stresses in thin cylinders and thick cylinders.
6. Calculate the power transmitted in shafts and stresses in columns under various loads.

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B.Tech. III Semester **COURSE CODE: UR23PCME305** **L T P C**
3 0 0 3

MATERIAL SCIENCE AND METALLURGY

Internal Marks: 30
External Marks: 70

Course Objective:

To understand the basic fundamentals of Material science and Physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

UNIT - I

Structure of Metals and Constitution of alloys: Atomic structure and bonding in materials. Crystal structure of materials, crystal systems, unit cells and space lattices, miller indices of planes and directions, packing factor for SC, BCC, FCC and HCP structures - crystallization of metals- Crystal growth techniques, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size- Imperfections in crystalline solids and their role in influencing various properties- types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT –II

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, Lever rule. Study of important binary phase diagrams of Cu-Ni, Al-Cu, Bi-Cd and Fe-Fe_3C.

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UNIT –III

Cast Iron and Steels: Necessity of alloying, Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Heat treatment of Alloys: Effect of alloying elements on Fe-Fe_3C system, Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – IV

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

Ceramics: Crystalline ceramics, glasses, cermets, abrasive materials, nanomaterials – definition, properties and applications of the above.

UNIT – V

Composite materials: Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites.

Powder metallurgy-Definition, properties, applications and steps in manufacturing.

Text Books:

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill

2. Essential of Materials science and engineering - Donald R.Askeland - Cengage.

References Books:

1. Material Science and Metallurgy – Dr. V.D.Kodgire.

2. Materials Science and Engineering -Callister&Baalasubrahmanyam

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3. Material Science for Engineering students – Fischer – Elsevier Publishers
4. Material science and Engineering - V. Rahghavan
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publications

Course outcomes:

Upon successful completion of the course, the students will be able to

1. Learn about bonds in metals & alloys and formation of solid solutions and other compounds
2. Understands the regions of stability of the phases in order to solve the problems in practical metallurgy
3. Know about cast irons and steels, their properties and practical applications.
4. Understand the affect of various alloying elements on iron-iron carbide system.
5. Learn the properties and applications of non-ferrous metals and alloys.
6. Learn about ceramics, composite and other advanced materials so as to use the suitable material for practical applications.

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B.Tech. III Semester **COURSE CODE: UR23ES311** **L T P C**

0 0 3 1.5

MECHANICS OF SOLIDS AND MATERIALS SCIENCE LAB

Internal Marks: 30

External Marks: 70

NOTE: Any 6 experiments from section A and B.

(A) Mechanics of Solids Lab

Course Objective:

• To impart hands on training to examine the mechanical properties of materials.

List of Experiments

1. Direct tension test
2. Bending test on

a) Simple supported

b) Cantilever beam

3. Torsion test
4. Hardness test

a) Brinells hardness test

b) Rockwell hardness test

5. Test on springs
6. Compression test
7. Impact test
    a. Izod
    b. Charpy
8. Punch shear test

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Determine the young's modulus, rigidity modulus of materials and stresses induced in bars and beams of uniform cross section.
2. Determine the hardness number.
3. Determine the stiffness of spring.
4. Determine the impact strength of materials.

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5. Determine the shear stress under single shear and double shear.

(B) Metallurgy Lab

Course Objective

• To impart hands on training in preparation of metal specimen so as to observe the microstructure.

List of Experiments

9. Study of the Micro Structures of Cast Irons.
10. Study of the Micro Structures of Non-Ferrous alloys.
11. Study of the Micro structures of Heat treated steels.
12. Hardenability of steels by Jominy End Quench Test.
13. Preparation and study of the microstructure of pure metals like Iron, Cu and Al.
14. Preparation and study of the microstructure of mild steels, low carbon steels, high- C steels.

Note: Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations.

In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

Course Outcomes

Upon successful completion of the course, the students will be able to

1. Prepare the Specimen using rough grinding, finish grinding and polishing.
2. Determine the hardness number and stiffness of spring.
3. Use different types of etchants to expose the microstructure of metal and alloys.
4. Observe the microstructure and ascertaining the same.
5. Perform Jominy End Quench test.
6. Observe the behavior of metal during fracture.

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B.Tech. III Semester **COURSE CODE: UR23PCME314** **L T P C**

0 0 3 1.5

COMPUTER AIDED MACHINE DRAWING

Internal Marks: 30
External Marks: 70

Course Objectives:

- To impart the fundamental knowledge on using various modeling tools like AUTO CAD and CATIA for Engineering design.
- To know various fields of engineering where these tools can be effectively used to improve the output of a product.
- To impart knowledge on how these tools are used in Industries by solving some real time problems using these tools.

LIST OF EXPERIMENTS:

1. Introduction to various commands in AUTOCAD.
2. Generation of points, Lines, polygons in AUTOCAD.
3. Introduction to modify commands in AUTOCAD.
4. 2D Sketch-1 using AUTOCAD.
5. 2D Sketch-2 using AUTOCAD.
6. 2D Sketch-3 using AUTOCAD.
7. 2D Sketch-4 using AUTOCAD.
8. 2D Sketch-5 using AUTOCAD.
9. 2D Sketch-6 using AUTOCAD.
10. Design of 2D machine component – 1 using CATIA.

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11. Design of 2D machine component – 2 using CATIA.

12. Design of 2D machine component – 3 using CATIA.

13. Design of 2D machine component – 4 using CATIA.

14. Design of 2D machine component – 5 using CATIA.

Packages to be provided to cater to drafting, modeling & analysis from the following:

AUTO CAD, CATIA, Pro-E, I-DEAS.

Course Outcomes:

Upon successful completion of this course student should be able to:

1. Appreciate the utility of the tools like Auto CAD and CATIA in solving real time problems and day to day problems.
2. Use the tools for any engineering and real time applications.
3. Acquire knowledge on utilizing these tools for a better project in their curriculum as well as they will be prepared to handle industry problems with confidence when it matters to use these tools in their employment.
4. Create solid models and sectional views of machine components.
5. Generate solid models of machine parts and assemble them.
6. Translate 3D assemblies into 2D drawings.

Note: Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations.

In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

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B.Tech. III Semester **COURSE CODE: UR23ES312**

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0	0	2	1

PYTHON PROGRAMMING LAB

Internal Marks: 30
External Marks: 70

Course Objective: To understand the PYTHON environment and make numerical computations and analysis.

Write Programs in PYTHON Programming for the following:

1. To find the roots of non-linear equation using Newton Raphson's method.
2. Curve fitting by least – square approximations
3. To solve the system of linear equations using Gauss - elimination method
4. To solve the system of linear equations using Gauss - Siedal method
5. To solve the system of linear equations using Gauss - Jordan method
6. To integrate numerically using Trapezoidal rule
7. To integrate numerically using Simpsons rule
8. To find the largest eigen value of a matrix by Power – method
9. To find numerical solution of ordinary differential equations by Euler's method
10. To find numerical solution of ordinary differential equations by Runge-Kutta method
11. To find numerical solution of ordinary differential equations by Milne's method
12. To find the numerical solution of Laplace equation
13. To find the numerical solution of Wave equation
14. To find the solution of a tri-diagonal matrix using Thomas algorithm
15. To fit a straight using least square technique

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Online Learning Sources

https://www.udemy.com/course/python-the-complete-python-developer-course/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaign=BG-Python_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=udemyads&utm_source=bing&utm_term=_._ag_1220458320107116_._ad__._kw_Python+language_._de_c_._dm__._pl__._ti_kwd-76278984197882%3Aloc-90_._li_116074_._pd__._&couponCode=IND21PM

- https://www.w3schools.com/python/python_intro.asp
- https://www.youtube.com/watch?v=eWRfhZUzrAc
- https://onlinecourses.nptel.ac.in/noc20_cs83/preview
- https://www.edx.org/learn/python
- Virtual Labs - https://python-iitk.vlabs.ac.in/
- Virtual Labs - https://virtual-labs.github.io/exp-arithmetic-operations-iitk/
- Virtual Labs - https://cse02-iiith.vlabs.ac.in/
- https://mlritm.ac.in/assets/cse/cse_lab_manuals/R20_cse_manuals/Python%20Lab%20Manual.pdf

Course Outcomes:

1. Solve the different methods for linear, non-linear and differential equations
2. Learn the PYTHON Programming language
3. Familiar with the strings and matrices in PYTHON
4. Write the Program scripts and functions in PYTHON to solve the methods
5. Evaluate different methods of numerical solutions.
6. Extract and import packages for developing different solutions for real time problems.

Note: Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

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B.Tech. III Semester **COURSE CODE: UR23SEC313B**

L	T	P	C
0	1	2	2

SOFT SKILLS LAB

Internal Marks: 30
External Marks: 70

Course Objectives:

- To prepare to face global competition for employment and excellence in profession.
- To help the students understand and build interpersonal and interpersonal skills that will enable them to lead meaningful professional life.

UNIT – 1: INTRODUCTION

Introduction- Emergence of life skills, Definition & Meaning, Importance& need, reasons for skill gap, Analysis--Soft Skills vs Hard skills, Linkage between industry and soft skills, Challenges, Personality Developments. Soft Skills, Soft Skills vs English - Improving Techniques.

UNIT – II: Intra-Personal:

Definition-Meaning – Importance - SWOT analysis, Johari windows - Goal Setting- quotient skills - Emotional Intelligence - Attitudinal skills - Right thinking- Problem Solving - Time management, stress management.

UNIT – III: Inter-Personal:

Definition – Meaning – Importance - Communications skills - Team Work, managerial skills - Negotiation skills - Leadership skills, corporate etiquettes.

UNIT – IV: Verbal Skills:

Definition and Meaning - Listening skills, need - types, advantages, Importance - Improving Tips for Listening, Speaking, need - types, advantages, Importance - Improving Tips, Reading - Writing Skills, Report, Resume, statement of purpose, need - types, advantages, Importance - Improving Tips .

UNIT – V: Non Verbal Skills & Interview skills

Definition and Meaning – Importance - Facial Expressions - Eye Contact – Proxemics - Haptics - Posture, cross cultural body language, body language in

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interview room, appearance and dress code – Kinetics - Para Language - tone, pitch, pause, neutralization of accent, use of appropriate language, Interview skills, interview methods and questions.

Text Books:

1) Sherfield, M. Robert at al, Cornerstone Developing Soft Skills, 4/e, Pearson Publication, New Delhi, 2014. 2) Alka Wadkar, Life Skills for Success, 1/e, Sage Publications India Private Limited, 2016.

Reference Books:

1. Sambaiah .M. Technical English, Wiley publishers India. New Delhi. 2014. 2. Gangadhar Joshi, From Campus to Corporate, SAGE TEXT.

3. Alex.K, Soft Skills, 3rd ed. S. Chand Publication, New Delhi, 2014.

4. Meenakshi Raman and Sangita Sharma, Technical Communication: Principle and Practice, Oxford University Press, 2009.

5. Shalini Varma, Body Language for Your Success Mantra, 4/e, S. Chand Publication, New Delhi, 2014. 6. Stephen Covey, Seven Habits of Highly Effective People, JMD Book, 2013.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc20_hs60/preview
- http://www.youtube.com/@softskillsdevelopment6210
- https://youtube.com/playlist?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q&si=Fs05Xh8ZrOPsR8F4
- https://www.coursera.org/learn/people-soft-skills-assessment?language=English
- https://www.edx.org/learn/soft-skills

Course Outcomes:

1. Assimilate and understood the meaning and importance of soft skills and learn how to develop them.

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2. Understand the significance of soft skills in the working environment for professional excellence.
3. Prepare to undergo the placement process with confidence and clarity.
4. Ready to face any situation in life and equip themselves to handle them effectively.
5. Understand and learn the importance of etiquette in both professional and personal life.
6. Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work.

Note:

Skill Oriented Course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

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B.Tech. III Semester **COURSE CODE: UR23MC300** **L T P C**
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ENVIRONMENTAL SCIENCE

Internal Marks: 30

End semester Marks: 70

External Marks: 00

Course Objectives:

Basic understanding of the ecosystem and its diversity.

Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.

An understanding of the environmental impact of developmental activities.

Awareness on the social issues, environmental legislation and global treaties.

UNIT-I:

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance–Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects; Role of information technology in environment and human health.

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 Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic eco systems.

UNIT-II:

Natural Resources: Natural resources and associated problems. Forest resources: Use and over – exploitation, deforestation – 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. Food resources: World food problems, changes caused

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by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Land resources: land degradation, Waste land reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources ;Equitable use of resources for sustainable life styles.

UNIT-III:

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity-classification- Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India asamega-diversity nation-Hot-sports of biodiversity-Threats to biodiversity: habitat loss, man-wildlife conflicts.- Endangered and endemic species of India–Conservation of biodiversity :conservation of biodiversity.

UNIT –IV:

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his wellbeing.

Solid Waste Management : Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT–V:

Social Issues and the Environment: Urban problems related to energy-Water conservation, rain water harvesting - Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act –Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution)Act-Wild life Protection Act –Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

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Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.

The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

TEXT BOOKS:

1. Environmental Studies, K.V.S.G.Murali Krishna,VGS Publishers, Vijayawada
2. Environmental Studies, R.Rajagopalan, 2ndEdition, 2011,Oxford University Press.
3. Environmental Studies, P. N. Palanisamy, P.Manikandan, A. Geetha, and K. Manjula Rani ; Pearson Education, Chennai

REFERENCE BOOKS:

1. Text Book of Environmental Studies, Deeshita Dave &P.Udaya Bhaskar, Cengage Learning.
2. A Text book of Environmental Studies, Shaashi Chawla, TMH, NewDelhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, NewDelhi
4. Perspectives in Environment Studies, Anubha Kaushik, CP Kaushik, New Age International Publishers, 2014.
5. https://nptel.ac.in/courses/127/105/127105018/

COURSE OUTCOMES:

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

1. Gain knowledge on natural resources, ecology, Biodiversity, and conservation of natural resources
2. Know various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
3. Understand social issues both rural and urban environment and the possible means to combat the challenges

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4. Study the Environmental Impact Assessment and environmental legislations of India and global initiatives towards sustainable development.
5. Understand the concept of Biodiversity and its conservation
6. Understand the concept of Solid Waste Management

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B.Tech. IV Semester **COURSE CODE: UR23HM401B** **L T P C**

2 0 0 2

INDUSTRIAL MANAGEMENT

Internal Marks: 30

External Marks: 70

Course Objectives:

To impart fundamental knowledge and skill sets required in the Industrial Management and Engineering profession, which include the ability to apply basic knowledge of mathematics, probability and statistics, and the domain knowledge of Industrial Management and Engineering

To produce graduates with the ability to adopt a system approach to design, develop, implement and innovate integrated systems that include people, materials, information, equipment and energy.

To enable students to understand the interactions between engineering, business, technological and environmental spheres in the modern society.

To enable students to understand their role as engineers and their impact to society at the national and global context.

UNIT – I

Introduction: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

UNIT – II

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

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UNIT – III

Operations Management: 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,

Resource Management: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance

UNIT – IV

Statistical Quality Control: Quality control, its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – X and R – charts P AND S charts, numerical examples.

Total Quality Management: zero defect concept, quality circles, implementation, applications, ISO quality systems, lean manufacturing-introduction, implementation and applications. six sigma – definition, basic concepts

UNIT – V

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

Project Management: PERT, CPM – differences & applications, critical path, determination of floats, importance, and numerical examples.

Text Books:

1. Industrial Engineering and management / O.P Khanna/Khanna Publishers.

2. Industrial Engineering and Production Management/MartandTelsang/S.Chand& Company Ltd. New Delhi

Reference Books:

1. Industrial Management / Bhattacharya DK/Vikas publishers

2. Operations Management / J.G Monks/McGrawHill Publishers.

3. Industrial Engineering and Management Science/ T. R. Banga, S. C. Sharma, N. K. Agarwal/Khanna Publishers

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4. Principles of Management /Koontz O' Donnel/McGraw Hill Publishers.

5. Statistical Quality Control /Gupta/Khanna Publishers

6. Industrial Engineering and Management /NVS Raju/Cengage Publishers

7. https://nptel.ac.in/courses/112/107/112107142/

Course Outcomes:

Upon successful completion of this course you should be able to:

1. Design and conduct experiments, analyze, interpret data and synthesize valid conclusions
2. Design a system, component, or process, and synthesize solutions to achieve desired needs
3. Use the techniques, skills, and modern engineering tools necessary for engineering practice.
4. Adopt appropriate considerations for public health and safety, cultural, societal, and environmental constraints
5. Know functions work effectively within multi-disciplinary teams.
6. Understand the fundamental precepts of effective project management

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B.Tech. IV Semester **COURSE CODE: UR23BS402** **L T P C**
3 0 0 3

OPERATIONS RESEARCH

Internal Marks: 30
External Marks: 70

Course Objectives:

To learn the importance of Operations Research in the design, planning, scheduling, manufacturing and business applications and to use the various techniques of Operations Research in solving such problems.

UNIT – I

Introduction To Operation Research

Development – definition– characteristics and phases – types of operation research models – applications. Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT – II

Transportation Problem: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem.

Sequencing: Introduction – flow –shop sequencing – *n* jobs through two machines – *n* jobs through three machines – job shop sequencing – two jobs through 'm' machines.

UNIT – III

Theory of Games: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games - graphical method.

Waiting Lines: Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models–

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multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals.

UNIT – IV

Replacement: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT – V

Inventory: Introduction – single item – deterministic models – purchase inventory models with one price break and multiple price breaks – shortages are not allowed – stochastic models – demand may be discrete variable or continuous variable – instantaneous production. Instantaneous demand and continuous demand and no set up cost. ABC & VED Analysis

Dynamic Programming: Introduction – Bellman's principle of optimality – applications of dynamic programming- shortest path problem – linear programming problem.

Text Books:

1. Operations Research- Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd

2. Introduction to O.R/Hiller & Libermann/TMH

Reference Books:

1. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.

2. Operations Research: An Introduction/Hamdy A Taha/Pearson publishers

3. Operations Research / R.Pannerselvam/ PHI Publications.

4. Operations Research / Wagner/ PHI Publications.

5. Operation Research /J.K.Sharma/MacMilan Publ.

6. Operations Research/ Pai/ Oxford Publications

7. Operations Research/S Kalavathy / Vikas Publishers

8. Operations Research / DS Cheema/University Science Press

Ch. Seetha Rami

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9. Operations Research / Ravindran, Philips, Solberg / Wiley publishers
10.Operations Research – Manohar Mahajan / Dhanpat Rai & Co

Course Outcomes

Upon successful completion of the course, the students will be able to

1. Analyze the theoretical workings of the simplex method for linear programming and compute the problems using different methods.
2. Solve specialized linear programming problems like the transportation, assignment and sequencing problems.
3. Propose the best strategy using decision making methods under uncertainty and game theory.
4. To produce a dynamic system as a queuing model and compute important performance measures.
5. To examine the deteriorating and non-deteriorating items with time and solve the replacement problems in order to modernize the system
6. To analyze the inventory control problems using different mathematical techniques to develop an optimal solution & To control project activities by using the fundamentals of dynamic programming.

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B.Tech. IV Semester **COURSE CODE: UR23PCME403** **L T P C**
3 0 0 3

MANUFACTURING PROCESSES

Internal Marks: 30
External Marks: 70

Course Objective:

To impart basic knowledge and understanding about the primary manufacturing processes such as casting, joining, bulk forming, sheet metal forming and powder metallurgy and their relevance in current manufacturing industry; To introduce processing methods of plastics.

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, Principles of Gating, Gating ratio and design of Gating systems. Risers – Types, function and design, casting design considerations, Basic principles and applications of Centrifugal casting, Die casting and Investment casting.

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, Manual metal arc welding, submerged arc welding, and Inert Gas welding- TIG & MIG welding. Weld ability of metals, welding defects.

UNIT – III

Resistance welding, Solid state welding processes- Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Soldering & Brazing.

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UNIT – IV

Plastic deformation in metals and alloys, hot working and cold working, Strain hardening and Annealing. Bulk forming processes: Forging, Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; 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 – V

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, simple and compound dies, sheet metal layout. High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

Text Books:

1. Manufacturing Processes for Engineering Materials - Kalpakjain S and Steven R Schmid- Pearson Publ, 5th Edn.
2. Manufacturing Technology -Vol I- P.N. Rao- TMH

Reference Books:

1. Manufacturing Science – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd
2. Process and materials of manufacture- Lindberg- PHI
3. Production Technology- R.K. Jain- Khanna
4. Production Technology-P C Sharma-S. Chand
5. Manufacturing Processes- H.S. Shaun- Pearson
6. Manufacturing Processes- J.P. Kaushish- PHI
7. Workshop Technology /WAJ Chapman/CBS Publishers & Distributors Pvt.Ltd.

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Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Design patterns, gating, runner and riser systems
2. Learn various casting process based on the component
3. Learn various arc and solid state welding processes and select a suitable process based on the application and requirements
4. Understand the Extrusion and its characteristics.
5. Understand various bulk deformation processes
6. Understand various sheet metal forming and processing of plastics

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B.Tech. IV Semester **COURSE CODE: UR23PCME404**

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3	0	0	3

FLUID MECHANICS & HYDRAULIC MACHINES

Internal Marks: 30
External Marks: 70

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.

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.

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 stream line, momentum equation and its applications, force on pipe bend.

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

UNIT III

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.

UNIT IV

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies.

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.

UNIT V

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.

Text Books:

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.

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Reference Books:

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

Online Learning Resources:

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

Course Outcomes: COs

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

1. Know the concept of fluid and its properties, manometer, hydrostatic forces acting on different surfaces and also problem solving techniques.
2. Learn the basic laws of fluids, flow patterns, viscous flow through ducts.
3. Analyze fluid kinematics and dynamics
4. Know the hydrodynamic forces acting on vanes and their performance evaluation.
5. Learn the importance, function and performance of hydraulic turbines.
6. Understand concepts related to pumps

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B.Tech. IV Semester **COURSE CODE: UR23PCME405** **L T P C**
3 0 0 3

DESIGN OF MACHINE MEMBERS

Internal Marks: 30
External Marks: 70

Course Objectives:

- Provide an introduction to design of machine elements.
- Familiarize with fundamental approaches to failure prevention for static and dynamic loading.
- Explain design procedures to different types of joints.
- Teach principles of clutches and brakes and design procedures.
- Instruct different types of bearings and design procedures.

UNIT I:

Introduction, Design for Static and Dynamic loads

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials.

Design for Static Loads: Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

Design for Dynamic Loads: Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses.

UNIT II

Design of Bolted and Welded Joints:- Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints and eccentrically loaded bolted joints.

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Welded Joints: Strength of lap and butt welds, Joints subjected to bending and torsion. Eccentrically loaded welded joints.

UNIT III:

Power transmission Shafts and Couplings

Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.

Couplings: Design of flange and bushed pin couplings, universal coupling.

UNIT IV:

Design of Clutches, Brakes and Springs

Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

Brakes: Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.

Springs: Design of helical compression, tension, torsion and leaf springs.

UNIT V:

Design of Bearings and Gears

Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.

Design of Rolling Contact Bearings: Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

Design of Spur Gears: Spur gears, beam strength, Lewis equation, design for dynamic and wear loads.

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Textbooks:

1. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education, 2004.
2. V.B.Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.
3. Dr. N. C. Pandya &Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.

Reference Books:

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.
4. K. Mahadevan & K. Balaveera Reddy, Design data handbook, CBS Publications, 4/e, 2018.

Online Learning Resources:

1. https://www.yumpu.com/en/document/view/18818306/lesson-3-course-name-design-ofmachine-elements-1-nptel
2. https://www.digimat.in/nptel/courses/video/112105124/L01.html
3. https://dokumen.tips/documents/nptel-design-of-machine-elements-1.html
4. https://archive.nptel.ac.in/courses/112/105/112105125/
5. https://www.coursera.org/learn/machine-design1

Course Outcomes:

1. Estimate safety factors of machine members subjected to static and dynamic loads.
2. Design the fasteners subjected to variety of loads.

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3. Select of standard machine elements such as keys, shafts, couplings, springs and bearings.
4. Analysis and design of curved beams with various cross sections.
5. Design of clutches, brakes and springs.
6. Design of bearing and gears.

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B.Tech. IV Semester **COURSE CODE: UR23PCME411** **L T P C**

0 0 3 1.5

FLUID MECHANICS & HYDRAULIC MACHINES LAB

Internal Marks: 30
External Marks: 70

Course Objective:

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

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Verification of Bernoulli's theorem
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Coefficient of discharge using Venturi meter.
9. Coefficient of discharge using Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Coefficient of discharge using V- notch
13. Study experiment on pitot tube.
14. Study experiment on mouth piece

Note: Minimum 12 experiments of duration 3 periods each must be completed for the eligibility to appear for the semester end examinations.

In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

Course Outcomes:

Upon successful completion of the course, the students will be able to

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1. Measure the fluid flow using different flow measuring devices
2. Conduct a performance test on turbo machines at different operating conditions.
3. Demonstrate the devices used for measuring flow.
4. Compute major losses in pipes.
5. Illustrate the operating parameters of turbines.
6. Explain the working of different types of pumps.

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B.Tech. IV Semester **COURSE CODE: UR23PCME412** **L T P C**

0 0 3 1.5

MANUFACTURING PROCSSES LAB

Internal Marks: 30

External Marks: 70

Course Objective:

- To impart hands-on practical exposure on manufacturing processes and equipment.
- The students are required to understand the parts of various machine tools and operate them. They are required to understand the different shapes of products that can be produced on these machine tools.

I. Metal Casting

1. Pattern design and making
2. Melting and Casting

II. Forging:

3. Round to Square
4. U-Shape

III. Welding:

5. Gas welding
6. Lap & Butt Joints

IV. Metal Forming and Powder Metallurgy:

7. Blanking & Piercing operations and study of simple, compound and progressive dies.
8. Basic powder compaction and sintering
9. Study experiment on powder making.
10. Upsetting
11. Experiment on sheet bending
12. Study experiment on wire drawing/ Rolling

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V. Processing of Plastics:

13. Injection Moulding
14. Study experiment on Blow moulding

Note: Minimum 12 experiments of duration 3 periods each must be completed for the eligibility to appear for the semester end examinations.

In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

Course outcomes:

Upon successful completion of the course, the students will be able to

1. Learn to produce different parts from various manufacturing processes.
2. Learn operate different machine tools with understanding of work holders and operating principles to produce different part features to the desired quality.
3. Make moulds for sand casting.
4. Fabricate different types of components using various manufacturing techniques.
5. Adapt unconventional manufacturing methods.
6. Develop Different Weld joints.

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B.Tech. IV Semester COURSE CODE: UR23SEC413B

L	T	P	C
0	1	2	2

EMBEDDED SYSTEMS AND IoT

Internal Marks: 30

External Marks: 70

Course Objectives:

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

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

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

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

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

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Text Books:

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

Online Learning Sources

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview
3. https://archive.nptel.ac.in/courses/108/105/108105057/
4. https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin-embedded-systems-shape-the-world-microcontroller-input-output?index=product&objectID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-+Shape+The+World%3A+Microcontroller+Input%2FOutput&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems
5. https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of-things?index=product&queryID=e1322674dcb3d246be981d06692653 99&position=4&linked_from=autocomplete&c=autocomplete.
6. https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3&results_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257-a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch
7. Virtual Labs - http://vlabs.iitkgp.ac.in/rtes/

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8. Virtual Labs - https://cse02-iiith.vlabs.ac.in/
9. Virtual Labs - https://iotvirtuallab.github.io/vlab/Experiments/index.html

Course Outcomes:

1. Comprehend Microcontroller-Transducers Interface techniques.
2. Establish Serial Communication link with Arduino
3. Analyse basics of SPI interface.
4. Understand the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor.
5. Realize the revolution of internet in mobile devices, cloud and sensor networks.
6. Understand the concept of sensor Using Node MCU

Note1:

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he/she has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted

Note 2:

Skill Oriented Course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

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B.Tech. IV Semester **COURSE CODE: UR23BS414**

L	T	P	C
1	0	2	2

DESIGN THINKING & INNOVATION

Internal Marks: 30

External Marks: 70

Course Objectives:

The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

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.

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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 modeling, 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, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.

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3. William lidwell, Kritinaholden, & Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

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
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes:

1. Define the concepts related to design thinking.
2. Explain the fundamentals of Design Thinking and innovation.
3. Apply the design thinking techniques for solving problems in various sectors.
4. Analyze to work in a multidisciplinary environment.
5. Evaluate the value of creativity.
6. Understand about market our own product, about maintenance, Reliability and plan for startup.

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