Course Structure

R22

Mechanical Engineering

For

B.Tech 4-Year Degree Course

(Applicable for the students admitted into E1 from the Academic Year 2022-23)

(I – IV Years Syllabus)

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES

Basar, Nirmal, Telangana – 504107

FIRST YEAR (E1) – SEMESTER – II

Sl. No.	Course Code	Course Title	Course Category	L	T	P	Total Contact Hours	Credits
1	MA1201	Engineering Mathematics II	BSC	3	1	0	4	4
2	CY1201	Engineering Chemistry	BSC	3	0	0	3	3
3	CS1202	Programming for Problem Solving	ESC	3	0	0	3	3
4	ME1201	Engineering Mechanics	ESC	3	1	0	4	4
5	ME1202	Introduction to Manufacturing processes	PCC	2	0	0	2	2
6	CS1802	Programming for Problem Solving Lab	ESC	0	0	3	3	1.5
7	ME1801	Fuels and Lubricants Lab	BSC	0	0	2	2	1
8	ME1802	Engineering workshop	ESC	0	1	2	3	2
9	BM1205	Constitution of India	MC	2	0	0	2	0
Total								**20.5**

Category: **Basic Science Course** Subject Code**: MA1201**

Engineering Mathematics II

Internals: 40 Marks	**L - T - P - C**
Externals: 60 Marks	**3 - 1 - 0 - 4**

Course Outcomes:

At the end of the course student will be able to

- Solve first order linear differential equations and special non linear first order equations like Bernouli, Riccati & Clairaut's equations
- Compute double integrals over rectangles and type I and II" regions in the plane
- Explain the concept of a vector field and make sketches of simple vector fields in the plane.
- Explain concept of a conservative vector field, state and apply theorems that give necessary and sufficient conditions for when a vector field is conservative, and describe applications to physics.
- Recognize the statements of Stokes' Theorem and the Divergence Theorem and understand how they are generalizations of the Fundamental Theorem of Calculus.
- Able to solve the problems in diverse fields in engineering science using numerical methods.

UNIT-I

Ordinary Differential Equations of first order: Exact first order differential equation, finding integrating factors, linear differential equations, Bernoulli's , Riccati , Clairaut's differential equations, finding orthogonal trajectory of family of curves, Newton's Law of Cooling, Law of Natural growth or decay.

UNIT-II

Ordinary Differential Equations of higher order: Linear dependence and independence of functions, Wronskian of n- functions to determine Linear Independence and dependence of functions, Solutions of Second and higher order differential equations (homogeneous & non-homogeneous) with constant coefficients, Method of variation of parameters, Euler-Cauchy equation.

UNIT-III

Integral Calculus: Convergence of improper integrals, tests of convergence, Beta and Gamma functions - elementary properties, differentiation under integral sign, differentiation of integrals with variable limits - Leibnitz rule. Rectification, double and triple integrals,

computations of surface and volumes, change of variables in double integrals - Jacobians of transformations, integrals dependent on parameters – applications.

UNIT-IV

Laplace Transform (LT): Improper integrals; Beta and Gamma functions and their properties. Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of , LT of , LT of derivatives of $f(t)$, LT of integral of $f(t)$, Evaluation of improper integrals using LT, LT of periodic and step functions,

Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT

UNIT-V

Vector Differentiation: Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

Vector Integration: Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications. Numerical Methods: Introduction and motivation about numerical methods, True value, approximate value, error, error percentage, algebraic equations, transcendental equations, Newton-Raphson method, Bisection method.

Text Books:

1. Jain, Rajinder Kumar, and Satteluri RK Iyengar. Advanced engineering mathematics. Alpha Science Int'l Ltd., 2007.

References Books

1. Kreyszig, E. (2017). Advanced Engineering Mathematics: Wiley.
2. M.D., Raisinghania. Ordinary and Partial Differential Equations, 20th Edition: S. Chand Publishing.

Category: Basic Science Course **Subject Code: CY1201**

Engineering Chemistry

Internals: 40 Marks **L - T - P - C**
Externals: 60 Marks **3 - 0 - 0 - 3**

Unit I: Electrochemistry

Introduction to electrochemistry: Galvanic cell (Daniel cell), Nernst equation. Types of electrodes: metal-metal ion electrodes, metal-insoluble salt-anion electrodes, calomel electrode, gas-ion electrodes, hydrogen and chlorine electrodes, oxidation-reduction electrodes (quinhydrone electrode), amalgam electrodes and ion exchange electrode (glass electrode). EMF and applications of EMF: determination of pH of the solution, potentiometric titrations, Classification of commercial cells - primary cells (dry cell) and secondary cells (Lithium ion battery, Pb-acid storage battery). Fuel cells: H2-O2 fuel cell.

UNIT - II: Corrosion and water treatment.

Dry and wet corrosion and their mechanisms. Pilling - Bedworth Rule. Types of Corrosion: galvanic corrosion, concentration cell corrosion, pitting corrosion and stress corrosion. Factors influencing the rate of corrosion: Temperature, pH and dissolved oxygen. Corrosion Prevention methods: Cathodic protection – Sacrificial Anodic method and Impressed current method. Metallic coatings: galvanization and tinning methods. Water: Hardness of water, Degrees of hardness. Calculation of hardness by EDTA method. Disadvantages of hard water in boilers: priming, foaming, scales, sludges and caustic embrittlement. Treatment of boiler feed water: Zeolite process, Ion exchange process.

UNIT - III: Energy sources

Introduction. Definition and classification of fuels. Calorific value of a fuel, Characteristics of a good fuel. Coal, types of Coal. Analysis of Coal: Proximate and Ultimate analysis. Bomb Calorimeter and Junker's gas Calorimeter. Problems on calculation of calorific value. Liquid fuels Introduction .Synthetic Petrol: Fisher Tropsch process. Introduction to Bio-fuels: Bio-diesel, Biogas

Unit IV: Chemical kinetics

Introduction to rate of reaction and rate constant determination. Factors influencing rate of reaction. Complex reactions: definition and classification of complex reactions, definition of reversible reactions with examples, rate law derivation for reversible reactions. Consecutive reactions: definition, rate law derivation and examples of consecutive reactions. Parallel reactions: definition, rate law derivation and examples of parallel reactions. Steady-state approximation: introduction, kinetic rate law derivation by applying steady state approximation in case of the oxidation of NO and pyrolysis of methane.

UNIT - V: Nanochemistry

Introduction to nanomaterials, classification: Carbon based nanomaterials, metallic nanoparticles, metal oxide nanoparticles. Properties at nanoscale. Synthetic approaches: Top-Down (Photolithography, ball milling) and Bottom-Up (Sol-gel, Hydrothermal). Brief overview on characterization of nanomaterials: X-ray, SEM and TEM. Applications of nanomaterials

Reference Books

1. Jain P C. Engineering Chemistry. N.P.: Dhanpat Rai, 1997.
2. Chemistry for Engineers. India: Laxmi Publications Pvt Limited, 2008.
3. Srivastava, H. C.. Engineering Chemistry. India: Pragati Prakashan, 2011.
4. Agarwal, Shikha. Engineering Chemistry: Fundamentals and Applications. India: Cambridge University Press, 2019.

Category: **Engineering Science Course** Subject Code**: CS1202**

Programming for Problem Solving

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **3 - 0 - 0 - 3**

UNIT-I: Introduction to Programming & Arithmetic expressions and precedence, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). **Idea of Algorithm:** steps to solve logical and numerical problems. **Representation of Algorithm:** Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code. Arithmetic expressions and precedence.

UNIT-II: Conditional Branching , Loops & Arrays, Writing and evaluation of conditionals and consequent branching, Iteration and loops, Arrays (1-D, 2-D), Character arrays and Strings.

UNIT-III: Function & Basic Algorithms, Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-IV: Recursion & Structure, Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort, Structures, Defining structures and Array of Structures

UNIT-V: Pointers & File handling, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation) File handling (only if time is available, otherwise should be done as part of the lab)

Text Books

1. Gottfried, Byron S.. Schaum's Outline of Programming with C. United States: McGraw-Hill Education, 1996.
2. Balagurusamy. (2008). Programming in ANSI C: Tata McGraw-Hill.

Reference Books

1. Kernighan, B.W., & Ritchie, D.M. (1988). The C Programming Language: 2nd Edition: Prentice Hall.

Category: Professional core course **Subject Code: ME1201**

Engineering Mechanics

Internals: 40 Marks **L - T - P - C**
Externals: 60 Marks **3 - 1 - 0 - 4**

Course Outcomes:

CO1: To understand representation of force, moments for drawing free-body diagrams and analyze friction-based systems in static condition

CO2: To locate the centroid of an area and calculate the moment of inertia of a section. CO3: Apply of conservation of momentum & energy principle for particle dynamics and rigid body kinetics

CO4: Understand and apply the concept of virtual work, rigid body dynamics and systems under vibration

Unit I: Introduction to Engineering Mechanics

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Vector Mechanics- dot product, cross product, Problems

Unit II: Structural analysis and friction

Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines, Problems

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack, Problems

Unit III: Properties of surfaces and solids

Distributed Force: Centroid and Centre of Gravity; Centroids of a triangle, circular sector, quadrilateral, etc., Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications, Problems

Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook, Problems

Unit IV: Virtual Work and Energy Method:

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium, Problems

Unit V: Dynamics

Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique), Problems

Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies;

Text books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education

Reference books:

1. Reddy Vijaykumar K. and K. Suresh Kumar (2010), Singer's Engineering Mechanics
2. Bansal R.K. (2010), A Text Book of Engineering Mechanics, Laxmi Publications
3. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
4. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

Web References

1. https://nptel.ac.in/courses/112106286
2. https://www.digimat.in/nptel/courses/video/112103108/L01.html
3. https://unacademy.com/course/engineering-mechanics-gate-mechanical/J692OFFK

Category: **Engineering Science Course** Subject Code**: ME1202**

Introduction to Manufacturing processes

Internals (Theory) : 40 Marks **L - T - P - C**

Externals (Practical) : 60 Marks **2 - 0 - 0 - 2**

(i) THEORY

Course Objectives:

- To understand the basic manufacturing process of producing a component by casting, forming plastic molding, joining processes, machining of a component either by conventional or by unconventional processes.
- To understand the advanced manufacturing process of additive manufacturing process.

Course Outcome:

- Students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Module – 1: ***Metal Casting*****:** Introduction, Tools, Types of Patterns, Pattern Materials, Types of casting – Sand, Die and other casting processes and Applications

Module – 2: ***Metal Forming*****:** Introduction, Classification, Types of Bulk and sheet metal forming and Applications.

Module – 3: ***Powder Metallurgy*****:** Introduction, Powder production methods, Compaction, Sintering, Secondary operations and Applications.

Module – 4: ***Joining:*** Types of Joining, Introduction to Welding, Brazing and soldering, Arc, Solid state welding processes.

Module – 5: ***Conventional Machining processes*****:** Introduction to machining operations; Lathe operations, Drilling, Milling and Grinding.

Module – 6: ***Unconventional Machining processes***.

Module – 7: ***CNC Machining and Additive manufacturing***

Text Books:

1. Elements Of Workshop Technology Volume –1&2. India, Indian Book Distributing Company Calcutta, 2010.
2. Kalpakjian, Serope. Manufacturing Engineering and Technology. India, Pearson Education, 2001..

Reference Books

1. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Web References

1. https://onlinecourses.nptel.ac.in/noc20_me67/preview
2. https://nptel.ac.in/courses/112107144

Category: **Engineering Science Course** Subject Code**: CS1802**

Programming for Problem Solving Laboratory

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **0 - 0 - 3 - 1.5**

List of Experiments:

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems e.g., sum of series
5. 1D Array manipulation
6. Matrix problems, String operations
7. Simple functions
8. Recursive functions
9. Pointers and structures
10. File operations

Category: **Basic Science Course** Subject Code**: ME1801**

Fuels and Lubricants Laboratory

Internals: 40 Marks **L - T - P - C**
Externals: 60 Marks **0 - 0 - 2 - 1**

List of Experiments:

1. Determination Of Flash Point And Fire Point Of Liquid Fuels/Lubricants Using Ables Apparatus.
2. Determination Of Flash Point And Fire Point Of Liquid Fuels/Lubricants Using Pesky Martens Test
3. Carbon Residue Test: Liquid Fuels.
4. Determination Of Viscosity Of Liquid Lubricants And Fuels Using Saybolt Viscometer
5. Determination Of Viscosity Of Liquid Lubricants And Fuels Using red wood viscometer-I & II.
6. Determination Of Viscosity Of Liquid Lubricants And Fuels Using engler viscometer
7. Determination of calorific value of gaseous fuels using Junkers gas calorimeter.
8. Determination of calorific value of solid/liquid fuels using bomb calorimeter
9. Drop point and penetration apparatus for grease
10. ASTM distillation test apparatus
11. Cloud and pour point apparatus

Category: **Engineering Science Course** Subject Code**: ME1802**

Engineering Workshop

Internals: 40 Marks	**L - T - P - C**
Externals : 60 Marks	**0 - 1 - 2 - 2**

Course Outcomes: Upon completion of this laboratory course

- Students will be able to fabricate components with their own hands.

List of Experiments:

1. **Fitting –** To produce a Step Fit on the given work piece.

   - To produce a V Fit on the given work piece.

2. **Carpentry** – To produce a Half lap joint on the given wooden work part.

   - To produce a Dove tail joint on the given wooden work part.

3. **House Wiring** – To perform and understand the Series and Parallel wiring connections.

   - To perform and understand Staircase and Godown wiring connections.

4**. Tin Smithy** – To produce a Tray from the given sheet metal.

   - To produce a Cylinder from the given sheet metal.

5. **Welding** – To practice formation of a Bead on the given work piece.

   - To perform a Butt and a Lap joint on the given work piece.

6**. Foundry** – To prepare a Mold cavity using a Single piece pattern.

   - To prepare a Mold cavity using a Split piece pattern.

7. **Machining** – To perform a Plain turning operation, Facing operation on the given work piece.

   - To perform a Step and a Taper turning operation on the given work piece.

8. **Plastic molding** – Demonstration

9. **WIRE EDM, CNC, 3D Printer** - Demonstration

Constitution of India

(Mandatory Course)

Code: BMXX05

Externals: 60 Marks L-T-P-C*

Internals: 40 Marks 2-0-0-0

Course Objectives:

To realize the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.

To identify the importance of fundamental rights as well as fundamental duties.

To identify the importance of Directive Principles of State Policy.

To understand the functioning of Union and State Governments in Indian federal system.

Course Outcomes:

At the end of the course, the student will be able to:

Describe historical background of the constitution making and its importance for building a democratic India.

Explain the value of the fundamental rights and duties for becoming good citizen of India.

Comprehend the structure and philosophy of the Constitution

Understand the power and functions of various constitutional offices and institutions.

Realize the significance of the constitution and appreciate the role of constitution and itizen oriented measures in a democracy.

UNIT-I: Introduction to Indian Constitution

Meaning of Constitution

Historical background of Indian constitution: Regulating Act 1773,PittsIndiaAct 1784, Charter

Act of1813, Charter Act 1833, Charter Act 1853,TheGovernment of India Act of 1858, Indian

Councils Act of1861, India Council Act of1892, Indian Councils Act of1909, Government of India Act of 1919, Government of India Act of 1935, Indian Independence Act of 1947.

Making of the Indian constitution.

UNIT-II: Philosophy of the Indian Constitution

 Preamble of the Constitution

 Salient Features of Indian Constitution

UNIT-III: Contours of Constitutional Rights

Fundamental Rights

Right to Equality

Right to Freedom

Right against Exploitation

Right to Freedom of Religion

Cultural and Educational Rights

Right to Constitutional Remedies

UNIT-IV:

 Directive Principles of State Policy

 Fundamental Duties

UNIT-V: Union/Central Government

 Union Government

 Union Legislature(Parliament)

 LokSabha and Rajyasabha (with Powers and functions)

Union Executive:

 President of India (with Powers and Functions)

 Prime Minister of India (with Powers and Functions).

Text Books:

1. Indian Polity-M.Laxmi kanth

2. Indian Constitution-V.S.Bagad-Technical Publications.

3. Indian Constitution-D.Srinivasan- Himalaya Publishers.

Web References:

1. https://www.india.gov.in/my-government/constitution-India

SECOND YEAR (E2) – SEMESTER – II

Sl. No.	Course Code	Course Title	Course Category	L	T	P	Total Contact Hours	Credits
1	ME2201	Fluid Mechanics and Hydraulic Machines	PCC	3	1	0	4	4
2	ME2203	Manufacturing Technology I	PCC	3	1	0	4	4
3	ME2202	Dynamics of Machinery	PCC	3	1	0	4	4
4	EC2207	Electronics ICs application	ESC	3	0	0	3	3
5	ME2211	Composite Materials	PEC	3	0	0	3	3
6	ME2801	Fluid Mechanics & Hydraulic Machinery Lab	PCC	0	0	2	2	1
7	ME2802	Theory of Machines Lab	PCC	0	0	2	2	1
8	ME2803	Manufacturing Technology I Lab	PCC	0	0	2	2	1
9	HS2203	Soft skills	HSMC	0	0	2	2	1
Total								**22**

Category: Professional Core Course **Subject Code: ME2201**

Fluid Mechanics and Hydraulic Machines

Internals: 40 Marks **L - T - P - C**
Externals: 60 Marks 3 - 1 - 0 - 4

COURSE OUTCOMES:

- Able to know the fluid properties and their engineering significance.
- Able to determine the pressure at a point and identify the variation of pressure in a fluid.
- Able to understand the basic concepts of fluid motion.
- Able to analyze different flow characteristics of laminar and turbulent flows
- Able to understand the boundary layer and its significance along with the various concepts of boundary layer like its growth, thickness and separation.
- Able to understand the concept of flow around the submerged objects
- Able to know the characteristics of compressible fluids flow and Mach number and its significance

UNIT-I

Properties of Fluids: Introduction, definition of fluid, Units of measurement, Fluid Properties- mass density, specific weight, specific gravity, Viscosity, Newton's law of viscosity – Newtonian and non Newtonian fluids. Classification of fluids- Ideal and real.

Fluid Statics: Fluid pressure at a point, variation of Pressure in a fluid, measurement of Pressure-simple manometers, differential manometers.
Fluid Kinematics: Fundamentals of fluid flow –types of fluid flow, description of flow pattern, basic principles of fluid flow, continuity equation, acceleration of a fluid particles.

UNIT-II

Fluid dynamics: Introduction, forces acting on a fluid in motion, Euler's equation of motion, Bernoulli's equation, application of Bernoulli's equation – venturimeter, pilot tube. Impulse momentum equation, application of impulse momentum equation – Forces on a pipe bend.

Flow through pipes: Introduction, two types of flow – laminar and turbulent – Reynold's experiment. Laws of fluid friction, Darcy- Weisbach equation. Steady laminar flow- circular

pipes – Hagen-Poiscuille's law. Hydro dynamically smooth and rough boundaries and it's criteria and resistance to flow of fluid in smooth and rough boundaries – variation of friction factor.

UNIT-III

Boundary layer theory: Introduction, thickness of boundary layer, boundary layer along a flat thin plate and its characteristics. Laminar and turbulent boundary layer, laminar sub layer, separation of boundary layer and its control.

Fluid flow around submerged objects: Drag and lift – Introduction, types of drag, drag on a flat plate. Development of lift on immersed bodies – lift of an airfoil

UNIT-IV

Flow of compressible fluids: Introduction, concepts of compressible flow, continuity and energy equation, propagation of elastic waves due to compression of fluid, velocity of sound, Mach number and its significance, propagation of elastic waves due to disturbance of fluid stagnation properties, area velocity relationship for compressible flows.

UNIT-V

Pumps : Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps

Turbines : Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube- Specific speed, unit quantities

Reference books

1. K.Subramanya,Theory and Applications of fluid Mechanics, Tata McGraw-Hill Publishing Company Ltd., New Delhi,1993.
2. Vijay Gupta and Santhosh K. Gupta, Fluid Mechanics and its applications, wiley Eastern Ltd.,New Delhi,1984.
3. K.L.Kumar, Engineering Fluid Mechanics, Eurasia Publishing House PVT Ltd, New delhi,2009.
4. P.N.MOdi,andS.M.Seth., Hydralics and Fluid Mechanics, Standard Book House, 1995.
5. Fluid Mechanics & Hydraulic Machines, S.C. Gupta, Pearson Publishers.

Web References:

1. https://nptel.ac.in/courses/112105206
2. https://nptel.ac.in/courses/112104117
3. https://www.youtube.com/watch?v=h7jW4yAHUl0&list=PL9RcWoqXmzaJipa5bafQ3fgHEMC5iPNn9

Category: Professional Core Course **Subject Code: ME2203**

Manufacturing Technology I

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **3 - 1 - 0 - 4**

COURSE OUTCOMES:

- Able to understand the elements of casting, construction of patterns and gating systems, moulds, methods of moulding, moulding machines and solidification of castings of various metals.
- Able to understand the different types of welding processes, welds and weld joints, their characteristics, cutting of ferrous and non-ferrous metals by various methods.
- Able to understand the basic concept on one, two and three dimensional stress analysis, theory of plasticity; strain hardening, hot and cold working process.
- Able to understand the principles of Extrusion, rolling, forging processes, wire drawing and sheet metal processes, their applications and defects.
- Able to understand the limits, fits and tolerance. Indian standard system, international standard organization system
- Able to know the principles of working of the most commonly used instruments for measuring linear and angular distances
- Able to study the different types of comparators, optical measuring instruments, flatness measurement methods and measuring methods of surface roughness

UNIT – I

Casting: Introduction, Pattern allowances and their Construction. Principles of Gating, Gating ratio and design of Gating systems, time of filling the cavity. Moulds: definition, mould materials, types of moulds, moulding methods, moulding machines, tests. Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys.

Risers – Types, function and design, casting design considerations, Design of feeding systems i.e., sprue, runner, gate and riser, moulding flasks. Problems, Casting inspection and defects

UNIT – II

Welding : Classification of welding process, power characteristics, types of welds and welded joints and their characteristics, design of welded joints, Thermit welding and Plasma (Air and water) welding. Defects, causes and remedies. Problems

UNIT – III

Forming: Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, **Rolling:** Theory of rolling, Mechanics of rolling. **Extrusion:** Basic extrusion process and its characteristics, Analysis of wire drawing and extrusion. **Forging:** Principles of forging – Tools and dies, Analysis of Forging, **Deep Drawing:** Analysis of deep drawing, tests for measuring of formability.

UNIT-IV

Introduction, Accuracy and precision, Limits, Fits and Tolerances, ISO system. Types of interchangeability. Slip gauges and end bars. Height gauges, Abbe's rule, Types of micrometers. Tomlinson gauges, sine bar, autocollimator, calibration of precision polygons and circular scales. Dial indicator, Sigma mechanical comparator. Free flow and back pressure type Pneumatic comparators. Contact & non-contact tooling, Applications of single and multijet gauge heads; computation and match gauging.

UNIT-V

Taylor's principles for plain limit gauges. Usage and limitations of Ring and Snap gauges. Indicating type limit gauges. Position and receiver gauges, principles of thread gauging. Gauge materials and steps in gauge manufacture. Surface roughness characteristics and its measurement. Tool maker's microscope, Floating carriage diameter measuring machine and coordinate measuring machine. Measurement of straightness and flatness using autocollimator. Roundness measurement with intrinsic datum (V-block, Bench centers) and extrinsic datum (TALYROND).

TEXT BOOKS:

1. Rao, P.N. (2013). Manufacturing Technology: Metal Cutting and Machine Tools: McGraw Hill Education (India).
2. Kalpakjian, Serope. Manufacturing Engineering and Technology. India: Pearson Education, 2001.

REFERENCES:

1. R. k Jain,Production Technology. India: Khanna Pub., 1989.
2. Lindberg, Roy A.. Processes and Materials of Manufacture. India: Allyn and Bacon, 1990.
3. Heine, R.W., Loper, C.R., & Rosenthal, P.C. (1976). Principles of Metal Casting: McGraw-Hill Education.
4. Parmar, R. S.. Welding Processes and Technology. India: Khanna Publishers, 2001.
5. Rajput, RK. (2007). A Textbook of Heat and Mass Transfer: S. Chand Publishing.
6. Noorani, Rafiq. Rapid prototyping : principles and applications. United Kingdom: Wiley, 2006.
7. Jain VK (2002) Advanced Machining Processes. Allied, New Delhi.

8. Narayana, K. L.. Production Technology. India: I.K. International Publishing House Pvt. Limited, 2010.

Web References:

1. https://archive.nptel.ac.in/courses/112/107/112107219/
2. https://onlinecourses.nptel.ac.in/noc22_me28/preview

Category: **Professional Core Course** Subject Code**: ME2202**

Dynamics of Machinery

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **3 - 1 - 0 - 4**

COURSE OBJECTIVES:

- To find static and dynamic forces on planar mechanisms.
- To know the causes and effects of unbalanced forces in machine members.
- To determine natural frequencies of undamped, damped and forced vibrating systems of one, two and multi degree freedom systems.

COURSE OUTCOMES:

- Able to analyze the planar mechanism by performing static and dynamics force analysis.
- Able to apply gyroscopic principles on Aero plane, ship, four wheel and two wheel vehicles
- Able to understand the basic concepts of friction in inclined plane, in screw and nuts, pivots and collars with uniform pressure and uniform wear
- Able to understand how to draw turning moment diagram and can design a flywheel for IC engine
- Able to understand the basics concepts of governors and forces acting on various governors and able to solve numerical problems on different governors
- Able to balance rotating and reciprocating mass in various planes and able to understand balancing of V- engine and multi cylinder engines
- Able to perform analysis of the response of one degree of freedom systems with free and forced vibrations and can evaluate the critical speed of the shaft and can understand torsional vibrations
- Able to understand two and three rotor systems and can solve simple vibration calculations of rotor systems.

UNIT – I

Static and Dynamic force analysis: Analysis of four bar and slider crank mechanism, Inertia Forces of a Reciprocating Engine Mechanism

Flywheel: Turning moment diagram for steam engine, I.C. engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design.

UNIT –II

Gyroscope: effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

Governors: Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting –effort and power of a governor.

UNIT – III

Balancing: Balancing of rotating masses - single and multiple – single and different planes.

Balancing of Reciprocating Masses: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V, multi cylinder, in -line and radial engines for primary and secondary balancing, locomotive balancing – Hammer blow, Swaying couple, variation of tractive force.

UNIT – IV

Brakes*:* block brakes, band brakes, band and block brakes, internal expanding brake.

Dynamometers: Introduction, types - prony, rope brake, epi-cyclic, Bevis Gibson and belt transmission dynamometers.

UNIT – V

Vibrations: Introduction, types of vibrations, free longitudinal vibrations, damped vibrations, logarithmic decrement, forced vibrations, vibrations isolation and transmissibility, transverse vibrations, whirling of shafts, critical speeds.

TEXT BOOKS:

1. Rattan, S.S. (2014). Theory of Machines: McGraw-Hill Education (India) Private.
2. Khurmi, R. S.., Gupta, J. K.. Theory of Machines. India: Eurasia Publishing House, 2005.

REFERENCES:

1. Rao, J. S.., Dukkipati, Rao V.. Mechanism and Machine Theory. India: New Age International (P) Limited, 2007.
2. Ballaney, P. L.. Theory Of Machines And Mechanisms. India: Khanna, 2003.
3. Bevan, Thomas. Theory of Machines, 3/e. India: Pearson Education, 2010.

4. Lal, Jagdish. Theory of Mechanisms & Machines. India: Metropolitan Book Company, 1985.

Web References:

1. https://archive.nptel.ac.in/courses/112/106/112106270/
2. https://www.digimat.in/nptel/courses/video/112105268/L01.html

Category: **Engineering Science Course** Subject Code**: EC2207**

Electronics IC Applications

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **3 - 0 - 0 - 3**

UNIT - I

Integrated Circuits: Classification, chip size and circuit complexity, basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp DC and AC characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

Op-Amp Applications: Basic applications of Op-amp- instrumentation amplifier, V to I and I to Vconverters, Differentiators and Integrators, Comparators, Schmitt Trigger.

UNIT - II

Active Filters & Oscillators: Introduction, 1st order LPF, HPF filters. Band pass, Band reject and all pass filters. Oscillator types and principle of operation – RC phase shift and, Wien bridge oscillators.

waveform generators – triangular, saw tooth, square wave generator

UNIT - III

Timers: Introduction to 555 timer, functional diagram, monostable and astable operations and applications.

D-A and A-D Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC. DAC and ADC specifications.

UNIT - IV

Number systems: Digital number systems; codes; Boolean algebra and logic gates: Karnaugh Map

Combinatorial circuits: Introduction, Adders and subtractor, Code converters, encoder and decoder; multiplexer, demultiplexer,

UNIT – V

Latches and Flip-flops, registers, counters

Memories: ROM architecture, types & applications, RAM architecture, Static & Dynamic RAMs.

TEXT BOOKS:

1. Jain, Shail., Roy Choudhury, D.. Linear Integrated Circuits. United Kingdom: New Age Science Limited, 2011.
2. Gayakwad, Ramakant A.. Op-amps and Linear Integrated Circuit Technology. United Kingdom: Prentice-Hall, 1983.
3. Jain, R. P.. Modern Digital Electronics. India: McGraw-Hill Education, 1997.

REFERENCE BOOKS:

1. Driscoll, Frederick F.., Coughlin, Robert F.. Operational Amplifiers & Linear Integrated Circuits. United Kingdom: Prentice Hall, 1998.
2. Dailey, Denton J.. Operational Amplifiers and Linear Integrated Circuits: Theory and Applications. United Kingdom: McGraw-Hill, 1989.
3. Franco, Sergio. Design with operational amplifiers and analog integrated circuits. Boston: WCB/McGraw-Hill, 1998.
4. Digital Fundamentals. India: Pearson Education, 2005.

Web References:

1. https://nptel.ac.in/courses/108108111

Category: Professional Core Course **Subject Code: ME2801**

Fluid Mechanics & Hydraulic Machinery Laboratory

Internals: 40 Marks	**L - T - P - C**
Externals: 60 Marks	**0 - 0 - 2 - 1**

Objectives:

- To understand the principles and performance characteristics of flow devices
- To know about the measurement of the fluid properties

Course Outcomes:

The students who have undergone the course will be able to measure various properties of fluids and characterize the performance of fluid machinery

List of the Experiments:

1. Measurement of Coefficient of Discharge of given Orifice meter
2. Measurement of Coefficient of Discharge of given Venturi meter
3. Measurement of minor losses in a given pipe
4. Determination of the performance characteristics of a single stage centrifugal pump
5. Determine the surface profile of free vortex comparison with their theoretical values.
6. Measurement of velocity of flowing fluid using pitot tube
7. Determination of the performance characteristics of Pelton Wheel
8. To demonstrate the phenomenon of pipe surge resulting from a change in velocity of water flowing through a pipe
9. Determine the centre of pressure for curved surface
10. Determine Reynold's number for Reynold's apparatus
11. Determine the metacentric height for ship model
12. Observe the stream lines for stream line apparatus

Category: **Professional Core Course** Subject Code**: ME2802**

Theory of Machines Laboratory

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **0 - 0 - 2 - 1**

List of Experiments:

1 Study various types of kinematics links, pairs & mechanisms.
2 Working models of various commonly used mechanisms and its inversions
3 Working models of various types of gears trains- Simple, Compound, Reverted and Epi- cyclic trains
4 To find experimentally the Gyroscopic couple on Motorized Gyroscope and compare with applied couple
5 To evaluate the performance on gravity controlled governors
6 To evaluate the performance on spring controlled governors
7 To find out experimentally the coriolli's component of acceleration and compare with theoretical values
8 To perform the experiment of Balancing of rotating parts and find the unbalanced couple and forces
9 To calculate the torque on a Planet Carrier and torque on internal gear using epicyclic gear train and holding torque apparatus
10 Working model of a various types of gear box i) Sliding mesh ii) Constant mesh iii) Synchromesh gear box
11 Rope Brake Dynamometer
12 Study on various types of Brakes
13 Study on working of rack and pinion steering gear mechanism
14 Study on working of differential
15 To study various types of cam and follower arrangements and To find out jump phenomenon of cams and followers with the help of test kit
16 To plot the follower displacement vs. angle of cam rotation curves for different cam follower pairs.

Category: **Professional Core Course** Subject Code**: ME2803**

Manufacturing Technology I Laboratory

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **0 - 0 - 2 - 1**

List of Experiments:

1. Cold Metal Transfer Welding
2. Resistance welding.
3. Plastic Extrusion. Sine Bar and Slip gauges.
4. Combination Die(Hydraulic Press)
5. Study and Applications of Profile Projector
6. Study and Applications of Tool Maker's Microscope

*Usage of Micrometers, Bevel Protractor height gauges, slip gauges, sine bar is performed wherever relevant

Category: HSM Course **Subject Code: HS2203**

Soft Skills

Externals: 60 Marks **L-T-P-C***
Internals: 40 Marks **2-0-0-1**

Course Outcomes

1. communicate effectively in formal and informal situations
2. understand the structure and mechanics of writing resumes, reports, documents and e-mails
3. present effectively in academic and professional contexts
4. develop communication in writing for a variety of purposes
5. identify areas of evaluation in Group Discussions conducted by organizations as part of the selection procedure
6. overcome stage fear and tackle questions

UNIT-I

Activities on Fundamentals of Inter-personal Communication

Starting a conversation - responding appropriately and relevantly - using the right body language-Role Play in different situations & Discourse Skills using visuals.

UNIT-II

Activities on Reading Comprehension

General Vs Local comprehension- reading for facts- guessing meanings from context- scanning- skimming- inferring meaning- critical reading – surfing Internet

UNIT-III

Activities on Writing Skills

Structure and presentation of different types of writing- Resume writing/ e-correspondence/ Technical report writing- planning for writing - improving one's writing.

UNIT-IV

Activities on Presentation Skills

Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations

UNIT-V

Activities on Group Discussion, Debate and Interview Skills - Dynamics of group discussion- intervention- summarizing-modulation of voice-body language-relevance-fluency and organization of ideas and rubrics for evaluation- Concept and process-pre-interview planning-opening strategies-answering strategies- interview through tele-conference & video-conferencing - Mock Interviews.

Text Books

1. Wentz, Frederick H.. Soft Skills Training: A Workbook to Develop Skills for Employment. United States: Create Space Independent Publishing Platform, 2012.
2. Maxwell, John C.. Everyone Communicates, Few Connect: What the Most Effective People Do Differently. United Kingdom: Thomas Nelson, 2010.
3. Lowndes, Leil. How to Talk to Anyone: 92 Little Tricks for Big Success in Relationships. United Kingdom: Thorsons, 1999.
4. Maxwell, John C.. Teamwork 101: What Every Leader Needs to Know. United States: HarperCollins Leadership, 2009.
5. Ryan, Mary Jane. Adaptability: How to Survive Change You Didn't Ask for. United States: Broadway Books, 2009.
6. Miller, R. Conflict Communication: A New Paradigm in Conscious Communication. YMAA Publication Center, 2016.

THIRD YEAR (E3) – SEMESTER – II

Sl. No.	Course Code	Course Title	Course Category	L	T	P	Total Contact Hours	Credits
1	ME3201	Power plant engineering	PCC	3	0	0	3	3
2	ME3202	Design of Transmission Elements	PCC	3	0	0	3	3
3	ME3203	Computer Aided Engineering	PCC	3	0	0	3	3
4	ME3204	Instrumentation and Control system	PCC	3	0	0	3	3
5	ME3222	Non Traditional Manufacturing Processes	PEC	3	0	0	3	3
6	BM3201	Managerial Economics and Financial Analysis	HSMC	3	0	0	3	3
7	ME3801	Thermal Engineering lab	PCC	0	0	2	2	1
8	ME3802	Computer Aided Engineering Lab	PCC	0	0	3	3	1.5
9	ME3803	Instrumentation and Control system lab	PCC	0	0	2	2	1
10	ME3900	Theme based project		0	0	2	0	1
Total								**22.5**

Category: Professional Core Course **Subject Code: ME3201**

Power Plant Engineering

Internals: 40 Marks **L - T - P - C**
Externals: 60 Marks **3 - 0 - 0 - 3**

Course Outcomes:

1. After completing this course, the students will get a good understanding of various practical power cycles and heat pump cycles.
2. They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines
3. They will be able to understand phenomena occurring in high speed compressible flows
4. They will understand the design and performance criteria for steam turbines
5. They will understand the concepts of nuclear and hydro electric power plants

UNIT-1:

Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations use free energy.

UNIT-2:

Vapor power cycles Rankine cycle with superheat, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance, reheat and regeneration, exergy analysis. Super-critical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Brayton cycle, essential components – parameters of performance – actual cycle – effect of reheat regeneration and intercooling- Combined gas and vapor power cycles

UNIT-3:

Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation- compressible flow in diffusers, efficiency of nozzle and diffuser.

UNIT-4:

Boilers and Classification based on Working principles & Pressures of operation -L.P & H.P. Boilers – Mountings and Accessories, equivalent evaporation, efficiency and heat balance and draught. Analysis of steam turbines, velocity and pressure compounding of steam turbines, Mechanical details – principle of operation, , degree of reaction –velocity diagram

UNIT-5:

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor, Pressurized Water Reactor, CANDU Pressurized Heavy Water Reactor, Fast Breeder Reactors. Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geo thermal, biogas and fuel cell power systems.

Text Books:

1. Borgnakke, Claus., Sonntag, Richard E Fundamentals of Thermodynamics. United Kingdom: Wiley, 2020.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd
5. Nag, P.K. (2002). Power Plant Engineering: Tata Mcgraw-Hill Publishing Company Limited.
6. Arora and Domkundwar, “A course in Power Plant Engineering” Dhanpat Rai & Sons.
7. M. M. EI- Wakil, “Power plant technology,” Tata McGraw - Hill.

Web References:

https://onlinecourses.nptel.ac.in/noc21_me86/preview

Category: Professional Core Course **Subject Code: ME3202**

Design of Transmission Elements

Internals: 40 Marks **L - T - P - C**
Externals: 60 Marks **3 - 0 - 0 - 3**

COURSE OUTCOMES:

1. Apply the knowledge of stress analysis, theories of failure, manufacturing and material science, and ergonomics principles in design of machine elements.
2. Analyze the stress and strain on mechanical components under different loadings; and understand, identify and quantify failure modes for mechanical parts.
3. Design various transmission elements such as Shafts, keys, couplings, Gears, Belt, Chain drives, Bearings, flywheels and clutches.
4. Able to make proper assumptions, perform correct analysis and finally decide the size of machine elements while giving due consideration to material, manufacturing method and cost of the element
5. Approach design problem successfully, and able to take decisions when no unique solution exists.

Unit-I Design of shaft, keys and coupling

Design of keys, shafts – solid, hollow shafts and splined shafts under torsion and bending loads.Design of couplings – Muff and Split Couplings, Flange, Flexible and Marine type of couplings.

Unit-II Design of gear drive

Gears: Introduction of gear drives, different types of gears, Materials used for gears. Standards for gears and specifications.

Spur Gear Design: Lewis equation, Beam strength of gear tooth and static design. Wear load and design for Wear. Dynamic loads on gear tooth. Design of Helical, Bevel and Worm gears, concepts of Design for manufacturability.

Unit-III Design of belt drive and chain drive

Design of belt drive systems, selection of belts and design of pulleys.Design of chain drives: Power rating of roller chains. Strength of roller chains

Unit-IV Bearing design

Bearings: Introduction. Materials used for Bearings. Classification of bearings and mounting of bearings.

Design of sliding contact bearings: Properties and types of Lubricants, Design of Hydrostatic and Hydrodynamic sliding contact bearings.

Design of Rolling Contact Bearings: Different types of rolling element bearings and their constructional details, static load carrying capacity. Dynamic load carrying capacity.Load-life relationship, selection of bearing life. Design for cyclic loads and speeds. Design of Ball and Roller bearings.

Unit-V Design of flywheel and clutch

Design of solid and rimmed type flywheel,

Requirement of clutch, Principle of clutch, Design of friction clutch- cone, centrifugal, single disc and multi disc clutch.

Text books:

1. V.B. Bhandari, Machine Design, Tata McGraw Hill Publication, 1991.
2. J.E. Shigley, C.R. Mischne, Mechanical Engineering Design, Tata McGraw Hill Publications, 2003.
3. Robert L. Norton, Machine Design: An Integrated Approach,2/e Pearson Education, 2000

REFERENCES:

1. Robert C. Juvinall, Fundamentals of Machine Component Design, John Wiley & Sons, 2005
2. M.F. Spotts, Design of Machine Elements, Prentice Hall of India, 1964.
3. P. Kannaiah, Machine Design, 2nd Edition, Scitech Publications. 2012,

Web References:

https://archive.nptel.ac.in/courses/112/106/112106137/

Category: **Professional Core Course** Subject Code**: ME3202**

Computer Aided Engineering

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **3 - 0 - 0 - 3**

COURSE OUTCOMES:

1. Understand the role of CAD in mechanical component and system design by creating geometric models and engineering drawings.
2. Use CAD software collaboratively when designing in a team.
3. Able to select type of modeling technique for given part
4. Use motion and interference checking to ensure that parts will not interfere throughout their complete range of motion.
5. Communicate effectively the geometry and intent of design features.

UNIT I

Computer Graphics:

Introduction to CAE, CAD. Role of CAD in Mechanical Engineering, Design process, software tools for CAD, geometric modelling. Transformations in Geometric Modeling: Translation, Scaling, Reflection, Rotation in 2D and 3D. Homogeneous representation of transformation, Concatenation of transformations. Projections: Projective geometry, transformation matrices for Perspective, Axonometric projections, Orthographic and Oblique projections. Implementation of the transformations and projection formulations using computer codes.

UNIT II

Geometric Modelling of curves

Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves hermite cubic splines Bezier curves B-splines rational curves. Implementation of the all the curve models using computer codes in an interactive manner

UNIT III

Geometric Modelling of surfaces

Mathematical representation surfaces, Surface model, Surface entities surface representation, parametric representation of analytic surfaces, plane surface, rules surface, surface of revolution, Tabulated Cylinder. Parametric Representation Of Synthetic Surfaces: Hermite Bicubic surface, Bezier surface, B- Spline surface, COONs surface, Blending surface Sculptured surface, Implementation of the all the surface models using computer codes.

UNIT IV

Geometric Modelling of solids

Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG). CAD/CAM Exchange: Evaluation of data — exchange format, IGES data representations and structure, STEP Architecture, implementation, CAD Applications

UNIT V

Basic Concepts of FEA:

Introduction, One Dimensional Problems: Basis steps, Discretization, Element equations, Linear and quadratic shape functions, Assembly, Local and global stiffness matrix and its properties, boundary conditions, penalty approach, multipoint constraints, Applications to solid mechanics, heat and fluid mechanics problems,

Text Book:

1. Saxena, A., & Sahay, B. (2005). Computer Aided Engineering Design: Springer Netherlands.
2. Zeid, Ibrahim. CAD/CAM theory and practice. Spain: McGraw-Hill, , 2009
3. Adams, J. Alan., Rogers, David F.., Adams, James Alan. Mathematical Elements for Computer Graphics. Germany: McGraw-Hill, 1990.

References:

4. Zeid, Ibrahim. Mastering CAD/CAM. United Kingdom: McGraw-Hill Higher Education, 2005.
5. Reddy, J. N, Junuthula Narasimha. An introduction to the finite element method. India: McGraw-Hill, 1993.

Web References:

1. https://archive.nptel.ac.in/courses/112/102/112102101/
2. https://archive.nptel.ac.in/courses/112/102/112102101/
3. https://nptel.ac.in/courses/112102102

Category: **Professional Core Course** Subject Code**: ME3204**

Instrumentation and Control Systems

Internals: 40 Marks	**L - T - P - C**
Externals: 60 Marks	**3 - 0 - 0 - 3**

COURSE OUTCOMES:

1. elucidate the construction and working of various industrial devices used to measure displacement, pressure, sound, flow, temperature, level, vibration.
2. ability to analyze, formulate and select suitable sensor for the given industrial applications.
3. able to describe the type of System, dynamics of physical systems, to represent system by transfer function
4. demonstrate the working and application of different type of actuators and control valves
5. able to apply techniques for controlling devices automatically.

UNIT I

Transducer Variables And Measurement Signals

Three stages of generalized measurement system– static characteristics of instruments-factors considered in selection of instruments – commonly used terms, error analysis and classification – sources of error – frequency response – displacement transducers – potentiometer, strain gauge – orientation of strain gauge, LVDT – variable reluctance transducers, proximity sensors, capacitance transducers, tacho generator; smart sensors, integrated sensors,, torque measurements,

UNIT II

Vibration And Temperature

Elementary accelerometer and vibrometer – seismic instrument for acceleration – velocity measurement, piezo electric accelerometer, temperature measurement-liquid in glass thermometer,pressure thermometer, resistance temperature detector, themcouples and thermopiles, thermistor, total radiation pyrometer, optical pyrometer – temperature measuring problem in flowing fluid.

UNIT III

Pressure And Flow Measurement

Manometer, elastic transducer, elastic diaphragm transducer – pressure cell, bulk modulus pressure gauge – Mc Leod gauge – thermal conductivity gauge, calibration of pressure gauge,

flow measurement – turbine type meter, hotwire anemometer, magnetic flow meter; liquid level sensors, light sensors, selection of sensors.

UNIT IV

Control systems

Basic elements of open/closed loop, design of block diagram; control method – P, PI, PID, when to choose what, tuning of controllers; Pneumatic, hydraulic, electric systems, Basic elements involved with PLC systems.

UNIT V:

System models

Models for physical systems in terms of simple building block, Transfer function – block diagram simplification techniques, and System response-System parameters, Concepts in Stability of systems. Frequency response- Construction of Bode plot,

Text Books:

1. Bolton, William. Instrumentation and Control Systems. Netherlands: Elsevier Science, 2004.
2. Marangoni, Roy D.., Lienhard, John H.., Beckwith, Thomas G.. Mechanical Measurements. United Kingdom: Addison-Wesley, 1993.
3. Doebelin, Ernest O.. Measurement Systems: Application and Design. Japan: McGraw-Hill, 1966.

References:

4. Nise, Norman S.. Control Systems Engineering. United Kingdom: Wiley, 2020.
5. Considine, Douglas M.., McMillan, Gregory K.. Process/Industrial Instruments and Controls Handbook, 5th Edition. United Kingdom: McGraw-Hill Education, 1999.

Web References:

1. https://nptel.ac.in/courses/108105064
2. https://nptel.ac.in/courses/103103037
3. https://onlinecourses.nptel.ac.in/noc22_ag04/preview

Category: **HSM Course** Subject Code**: BM3201**

MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS

Internals: 40 Marks	**L - T - P - C**
Externals: 60 Marks	**3 - 0 - 0 - 3**

Course Outcome: After the successful completion of this course, the learner will be able to know:

1. The dynamic game of demand and supply, and how the trinity of Economics i.e. Demand, Supply and Scarcity make the things move around the globe.
2. Principles of Microeconomics applied to industries.
3. Concept of forecasting and applying forecasting techniques to address the challenges and opportunities in the organization they work.
4. Cost and Production analysis, Break-Even analysis, Opportunity Cost, how to optimize organizational resources and how to minimize cost and maximize production, revenue and profit
5. Different pricing structure and discount mechanism suitable for business firms.
6. Market structure and how to exploit market structure for optimizing the benefits of organization.
7. Capital requirements and sources of capital.

UNIT I:

Introduction to Managerial Economics

Definition, Nature and Scope of Managerial Economics-Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting

UNIT II:

Theory of Production and Cost Analysis

Production Function - Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs. Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.000

Cost Analysis: Cost concepts, Opportunity cost. Fixed vs. Variable costs, Explicit costs Vs. Implicit costs. Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)- Determination of Break-Even Point (simple problems)- Managerial Significance and limitations of BEA

UNIT III:

Markets & Pricing Policies

Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Objectives and Policies of Pricing- Methods of Pricing: Cost Plus Pricing. Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing

UNIT IV:

Introduction to Financial Accounting

Introduction to Financial Accounting: Double entry Book Keeping, Journal, Ledger, Trail Balance and Final Accounts (Trading account, Profit and Loss Account and Balance sheet with simlvbple adjustments).

UNIT V:

Capital and Capital Budgeting

Capital and Capital Budgeting: Capital and its significance. Types of Capital. Estimation of Fixed and Working capital requirements. Methods and sources of raising finance. Nature and scope of capital budgeting, features of capital budgeting proposals. Methods of Capital Budgeting: Payback Method. Accounting Rate of Return (ARR) and Net Present Value Method, Internal Rate of Return (IRR).

Reference Books:

1. Aryasri. Managerial Economics And Financial Analysis: McGraw-Hill Education (India) Pvt Limited,2009.
2. Maheshwari, Yogesh. Managerial Economics. India: PHI Learning, 2012
3. Ahuja, Amit. Managerial Economics (Analysis of Managerial Decision Making), 9th Edition. India: S Chand Limited, 2017.
4. Raghunatha Reddy &Narasimhachary: Managerial Economics & Financial Analysis, Scitech, 2009.
5. V.Rajasekarn&R.Lalitha. Financial Accounting, Pearson Education. New Delhi. 2010
6. Suma Damodaran, Managerial Economics, Oxford University Press. 2009.

Web References:

1. https://www.digimat.in/nptel/courses/video/110105075/L01.html

Category: Professional Core Course **Subject Code: ME3801**

Thermal Engineering laboratory

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **0 - 0 - 2 - 1**

List of experiments:

1. To study Vapour Compression Refrigeration cycle with the help of refrigeration circuit under variable load conditions
2. To determine the Coefficient of Performance, Refrigeration capacity & Compressor work of Vapour Compression Refrigeration cycle with the help of refrigeration circuit under variable load conditions
3. To study Vapour Absorption Refrigeration cycle
4. To determine the Coefficient of Performance, Refrigeration capacity & Compressor work of Vapour Absorption Refrigeration cycle
5. To compare heat transfer for different heating elements in a cross flow heat exchanger
6. To study fundamental principles and various controls used in room air conditioning
7. To study different psychometric processes and estimating the change of state of air using air conditioner and illustrating them on psychometric diagram
8. Study on the characteristics of flame stability and methods to improve stability limits
9. Determination of flame speed based on the cone method
10. Determination of the relationship between flame speed and air/fuel ratio
11. flame separation demonstration
12. To study and determine performance parameters for Petrol Engine
13. To study and determine performance parameters for Diesel Engine

Category: **Professional Core Course** Subject Code**: ME3802**

Computer Aided Engineering laboratory

Internals: 50 Marks **L - T - P - C**

Externals: 50 Marks **0 - 0 - 3 - 1.5**

LIST OF EXPERIMENTS:

One dimensional analysis:

1. Structural analysis of cantilever beam under different types of loading

2. Structural analysis of simply supported beam under different types of loading

Two dimensional analysis:

3. Static structural analysis of Plate with hole
4. Transient structural analysis of rack and pinion

Three dimensional analysis:

5. Static structural analysis of Cotter Joint

6. Rigid dynamic analysis of Oldham coupling

7. Thermal analysis of Piston

Non linear analysis:

8. Non-linear analysis of sheet bending

9. Non-linear buckling analysis of column

Category: **Professional Core Course** Subject Code**: ME3803**

Instrumentation and Control Systems Laboratory

Internals: 40 Marks **L - T - P - C**

Externals: 60 Marks **0 - 0 - 2 - 1**

Sl.No	Name of the Experiment
1.	Calibration of Pressure Gauge using Dead Weight Tester (DWT)
2.	Measurement of displacement using Full bridge Strain Gauge circuit
3.	Measurement of displacement using Linear Variable Differential Transformer (LVDT)
4.	Motor speed measurement using Magnetic Pick Up Sensor, Photo Reflector Sensor, Photo Interruptive Sensor and Hall Effect Sensor
5.	Measurement of Torque Generated by AC (Induction motor) using Force Transducer.
6.	Weight measurement using Load cell
7.	Static Torque Measurement by using load cell.
8.	Measurement of Pressure using Transducer
9.	Strain measurement using strain gauges and cantilever assembly
10	Industrial PLC trainer
11	Motion control of Rotary inverted pendulum

THIRD YEAR (E4) – SEMESTER – II

Sl. No.	Course Code	Course Title	Course Category	L	T	P	Total Contact Hours	Credits
1	ME4261	Welding Technology	PEC	3	0	0	3	3
2	ME4403	Non Destructive Testing	OEC	3	0	0	3	3
3	ME4000	Comprehensive Viva	PCC	0	0	0	1	1
4	ME4902	Project-IV	PROJ	0	0	12	12	6
Total								**13**