CURRICULUM OF MECHANICAL ENGINEERING
RGUKT BASAR

II YEAR
II SEMESTER

Subject Code	Subject Name	L-T-P	C
MA2202	Engineering Mathematics –IV	4-0-0	4
ME2201	Dynamics of Machinery	4-0-0	4
ME2202	Fluid Mechanics	4-0-0	4
ME2203	Manufacturing Processes	4-0-0	4
EE2001	Basic Electrical and Electronics Engineering	4-0-0	4
BM2201	Personality Development-I	2-0-0	1
EE2601	Basic Electrical and Electronics Engineering Lab	0-0-3	2
ME2801	Manufacturing Processes Lab	0-0-3	2
ME2902	Seminar-II	0-0-2	1
Total		22-0-8	26

CODE: MA2202   **ENGINEERING MATHEMATICS-IV**

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

Internals: 40 Marks   **4-0-0-4**

Objectives:
  ➢ To introduce the student, the expansion of periodic functions, and their applications.
  ➢ To introduce the methods of forming and solving Partial differential equations, Also Z-Transforms
  ➢ To introduce basic statistical methods like curve fitting, correlation and regression.

UNIT –I
Fourier series and Fourier transforms: Fourier series, Fourier series expansions of even and odd functions, convergence of Fourier series, Fourier half range series, Fourier transforms, inverse Fourier transforms, Fourier cosine & sine transforms.

UNIT –II
Partial differential equations: Formation of first and second order partial differential equations, solution of first order equations, Lagrange's equation, Nonlinear first order equations, Charpit's method, higher order linear equations with constant coefficients.

UNIT-III
Application of Fourier series to linear partial differential equations: Classification of linear second order partial differential equations, separation of variables method (Fourier method), Fourier series solution of one dimensional heat equation, one dimensional wave equation, Laplace's equation.

UNIT –IV
Z-Transforms: Introduction, basic theory of Z-transforms, Z-transforms of standard sequences, existence of Z-transform, linearity property, translation theorem, scaling property, initial and final value theorems, differentiation of Z-transform, convolution theorem, solution of difference equations using Z-transforms.

UNIT-V
Curve fitting by method of least squares**,** correlation and regression, types of correlations, scatter diagram, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, equal ranks, correlation factor, equations to the lines of regression.

Suggested Reading:
1. Advanced Engineering Mathematics - R.K.Jain & S.R.K. Iyengar 3rd Edition, Narosa Publications for I, II, III, IV units.
2. Higher Engineering Mathematics-H.K. Dass, Er.Rajnish verma for unit V.
3. Kreyszig E, Advanced Engineering Mathematics, 8 th Edition, John Wiley & Sons Ltd, 2006.
4. Gupta & Kapoor: Fundamentals of Mathematical statistics, Sultan chand

CODE: ME2201   **DYNAMICS OF MACHINERY**

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

Internals: 40 Marks   **4-0-0-4**

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.

Unit-I
Static and Dynamic analysis of planar mechanisms: Graphical and analytical methods, Free body diagrams, Method of superposition, Equivalent offset inertia force, Inertia force in reciprocating engines, Flywheels.

Unit-II
Force analysis of space mechanisms, inertia matrix, Lagrangian and Newton-Euler formulation. Gyroscopic effect in shafts, aero planes, Naval ships, Two & Four wheel automobiles.

Unit-III
Forces on bearings due to rotating shaft carrying several eccentric rotors, balancing of shafts carrying several rotors, determination of balancing masses from the forces on the bearings shaking forces in a single cylinders engine, partial balancing of reciprocating engine. Balancing of a two cylinder locomotive engine, determination of unbalanced forces and couples.

Unit-IV
The role of a centrifugal governor in speed control, Porter and Hartnell type governors, speed vs lift curves, power and stability.
Undamped free vibration of a single degree of freedom linear system (axial and torisonal), determination of natural frequencies, equivalent system of combination of springs, stepped shafts, gears and rotors. Free response of single degree of freedom damped linear systems, damped natural frequencies, relative damping.
Vibration of harmonically forced single degree of freedom systems. Resonance, vibration isolation with coupled damper.
Partial differential equation governing free vibration of a simply supported uniform beam. Derivation of natural frequencies.

Unit-V
Natural frequencies of two degree freedom linear systems. Nodes in three rotor systems. Modes of vibration, Determining natural frequencies by Holzer's method for multi-rotor systems. Dunkerley's method, Raleigh's method.

Suggested Reading

1. S.S. Rathan, *Theory of Machines*, Tata-Mc Graw Hill, 1995.
2. A. Ghosh and Mallick, *Theory of mechanisms and machines*, Affiliated to E-W Press, 1988.
3. John.J.Vicker, Gordon R. Pennock, Joseph E. Shigley, *Theory of Machines & Mechanisms*, Oxford University Press, 2003.
4. Robert L. Norton, *Design of Machinery*, Tata Mc Graw Hill, 2005.
5. Charles E Wilson, J. Peter Sadler *Kinematics and Dynamics of Machinery* Pearson Education, 2008.

REFERENCES:
1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Dynamics of Machinery/Balleney/Dhanpat Rai
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of Machines / Jagadish Lal & J.M.Shah /Metropolitan.

CODE: ME2202   **FLUID MECHANICS**

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

Internals: 40 Marks   **4-0-0-4**

Objectives:
- To know various fluid properties, concept and method of fluid pressure measurement.
- To understand the basic concepts of fluid motion.
- To study different equations of fluid motion and fluid dynamics
- To analyze different flow characteristics of laminar and turbulent flows
- To study the motion of gases for different conditions of expansion

UNIT-I
Properties of Fluids: Introduction, definition of luid, 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.

UNIT-II
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.
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.

Dimensional analysis and similarity - Buckingham Pi theorem
.
UNIT-III
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. Hydrodynamically smooth and rough boundaries and it's criteria and resistance to flow of fluid in smooth and rough boundaries – variation of friction factor.

UNIT-IV
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-V
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.

Suggested Reading:

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,and S.M.Seth., Hydralics and Fluid Mechanics, Standard Book House, 1995.

5. Fluid Mechanics & Hydraulic Machines, S.C. Gupta, Pearson Publishers.

CODE: ME2203　　　　　**MANUFACTURING PROCESS**

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

Internals: 40 Marks　　　　　　　　　　　　　　　　　　**4-0-0-4**

Objectives:
- ➢ To know the various manufacturing processes
- ➢ To understand the basic concepts of casting and welding
- ➢ To understand the manufacturing of plastics and composites
- ➢ To familiarize the forming processes and forming load estimation.
- ➢ To understand the principle of high energy rate forming processes

UNIT – I
Casting: Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances, Principles of Gating, Gating ratio and design of Gating systems.

Solidification of casting – Concept – Solidification of pure metal and alloys, Risers – Types, function and design,
Special casting processes: Centrifugal, Die, Investment.
Methods of Melting: Crucible melting and cupola operation, Induction, reverboratory furnace.

UNIT – II
Welding : Classification of welding process types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.
Cutting of Metals: Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, non-ferrous metals.

Inert Gas welding, TIG & MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive, nondestructive testing of welds.

UNIT – III
Forming: Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, Rolling fundamentals – theory of rolling, types of Rolling mills. Forces in rolling and power requirements, plastic blow and injection moulding.

Extrusion: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion.

UNIT - IV
Forging processes: Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects.

Sheet metal working: stamping, forming and other cold working processes: Blanking and piercing – Bending.
Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning.

UNIT - V
ADVANCED MANUFACTURING PROCESS: Unconventional machining process: Introduction Classification – mechanical, thermal, chemical and hybrid process. Mechanical: - Ultrasonic machining,
Water jet machining: -Abrasive jet machining. Thermal: - Electro discharge machining. Laser beam machining, Electro beam machining. Chemical: - Chemical and Electro chemical machining. Hybrid: - Laser assisted Machining. Rapid manufacturing: - Introduction – concepts of rapid manufacturing, information flow for rapid prototyping, classification of rapid prototyping process, stereolithography, fused deposition modelling, selective laser sintering, Applications of rapid prototyping process.

TEXT BOOKS:
1. Manufacturing Technology, P.N. Rao,TMH
2. Manufacturing Technology, Kalpak Jain, Pearson education

REFERENCES:
1. Production Technology, R.K. Jain
2. Process and materials of manufacturing –Lindberg, PE
3. Principles of Metal Castings, Rosenthal.
4. Welding Process, Parmar
5. Manufacturing Technology, R.K. Rajput, Laxmi Pub
6. Rapid Prototyping Principles and Applications, Rafiq Noorani, Wiely Pub.
7. Unconventional Machining Processes, V.K. Jain, Allied Pub.
8. Production Technology, K.L Narayana, I.K. International Pub

CODE: EE2001   BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

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

Internals: 40 Marks   **4-0-0-4**

Objectives:
This course introduces the concept of

  ➢ Electrical DC and AC circuits, basic law's of electricity, different methods to solve the electrical networks
  ➢ Construction operational features of energy conversion devices i.e., DC and AC machines, transformers.
  ➢ It also emphasis on basics of electronics, semiconductor devices and their characteristics and operational features.

UNIT- I DC CIRCUIT ANALYSIS
Electrical Circuits - R-L-C Parameters, Voltage and Current Independent and Dependent Sources, Source Transformation – V–I relationship for Passive elements, Kirchoff's Laws, Network reduction techniques – series, parallel, series parallel, star–to-delta, delta-to-star transformation, Mesh Analysis and Nodal Analysis

UNIT- II AC CIRCUIT ANALYSIS
Single Phase AC Circuits - R.M.S. and Average values, Form Factor, steady state analysis of series, Parallel and Series parallel Combinations of R, L and C with Sinusoidal excitation, concept of reactance, Impedance, Susceptance and Admittance – phase and phase difference, Concept of Power Factor, j-notation, complex and Polar forms of representation.
Resonance – Series resonance and Parallel resonance circuits, concept of bandwidth and Q factor, Locus Diagrams for RL, RC and RLC Combinations for Various Parameters.

UNIT- III NETWORK THEOREMS AND THREE PHASE AC CIRCUITS
Network Theorems - Thevenin's, Norton's, Maximum Power Transfer, Superposition, Reciprocity, Tellegen's, Millman's and Compensation theorems
Three phase ac circuits -Three phase EMF generation, delta and Y connections, line and phase quantities, solution of three phase circuits, balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits

UNIT- IV BASIC ELECTRONICS

Introduction to electronics and electronic systems, Semiconductor and devices like diodes, zener diode, BJT, FET, MOSFET, Rectifier and ripple Filters, Transistor biasing. Small signal transistor amplifiers, Operational amplifiers, Feedback and Oscillators, Introduction to digital circuits

UNIT- V ELECTRICAL MACHINES
DC machines: Construction, EMF and Torque equations, Characteristics of DC generators and motors, speed control of DC motors and DC motor starters.

Transformers : Construction, EMF equation, ratings, phasor diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, auto-transformers.

Induction motors: The revolving magnetic field, principle of orientation, ratings, equivalent circuit, Torque-speed characteristics, starters for cage and wound rotor type induction motors.

TEXT BOOKS:

1. Electrical Technology- Hughes Prentice Hall, 7th edition
2. Problems In Electrical Engineering- S. Parker Smith, 9 edition
3. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
4. Millman's Electronic Devices and Circuits – J.Millman and C.C.Halkias, Satyabratajit, TMH, 2/e, 1998.
5. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 6th edition.
6. Electric Machines –by I.J.Nagrath & D.P.Kothari,Tata Mc Graw Hill, 7th Edition.2005

REFERENCES:

1. Electronic Devices and Circuits - K. Lal Kishore, B.S. Publications, 2nd Edition, 2005.
2. Electronic Devices and Circuits – Anil K. Maini, Varsha Agarwal –Wiley India Pvt. Ltd. 1/e 2009.
4. Network Theory by N.C.Jagan & C.Lakshminarayana, B.S. Publications.
5. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
6. Electrical machines-PS Bhimbra, Khanna Publishers.

BM2201 **PERSONALITY DEVELOPMENT**

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

Internals: 40Marks **2-0-0-1**

Guidelines: Learning approach is based on Real time case studies with class room activities

Course Objectives:
1. To develop interpersonal skills and be an effective goal oriented team player.
2. To develop professionals with idealistic, practical and moral values.
3. To develop communication and problem solving skills.
4. To re-engineer attitude and understand its influence on behavior.
5. To enhance holistic development of students and improve their employability skills.

UNIT I-SELF ANALYSIS **(6 hours)**

SWOT Analysis, Who am I, Personality Traits, Importance of Self Confidence, Self Esteem.

UNIT II-GOALS SETTINGS **(6 hours)**

Short term, Long term goal settings, SMART concept
Diversifying Risk and Optimizing Opportunities

UNIT III- TEAM DYNAMICS WITH INTERPERSONAL SKILLS **(8 hours)**

Team Dynamics, Team Work, Interpersonal Skills

Behavioral Skills GD, PI, Body Language Public Speaking, Verbal, Non Verbal Communications

UNIT IV-CREATIVITY AND RATIONALITY **(8 hours)**

Out of Box thinking, Idea Generation with creativity Brain Storming, Effective group meetings, Rationalization of ideas and way to effective implementation.

Class room and team activities coupled with group tasks depending upon time availability

CODE: EE2601   BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

Externals: 60Marks   **L-T-P-C**
Internals: 40Marks   **0-0-3-2**

List of Experiments:

1. Verification of Network Theorems

2. R-L-C Series Circuit

3. Series and parallel resonanance

4. Three phase power measurement by two Wattmeter method

5. Speed control of DC motor

6. OC and SC Test of Single Phase Transformer

7. OCC of separately excited DC Shunt Generator

8. V-I characteristics of Diodes and BJT

9. Half-wave and full-wave rectifiers, rectification with capacitive filters, zener diode

Studies on logic gates

CODE: ME2801   **MANUFACTURING PROCESS LAB**

Externals: 60Marks   **L-T-P-C**
Internals: 40Marks   **0-0-3-2**

Objectives:

List of experiments in Machining:
1. Milling of Spur gear
2. Effect of process parameter and machining involvement on chip formation in turning
3. Effect of process parameters in turning on cutting forces & temperatures
4. Regrinding of single point cutting tool

List of experiments in Casting:
1. Study on moulding properties like permeability, Green hardness, Dry tensile & compression strength, Green tensile & compression strength, Moisture measurement.
2. Study on riser design & shieve analysis.

List of experiments in Welding:
1. Study the characteristics of MIG welding with movable work table
2. Study of arc welding characteristics using automatic moving torch.
3. Demo of TIG and Resistance spot welding

List of experiments in Forming
1. Disc compression & Ring compression test
2. Extrusion & deep drawing

CODE: ME2902   **SEMINAR-II**

Scheme of Internal Exam   **: 25 Marks**
Credits   **: 1**

Objectives:

Objective of the project seminar is to actively involve the students in preparation of the final year project with regard to following components:

- ➢ Problem definition and specification
- ➢ Literature survey, familiarity with research journals
- ➢ Broad knowledge of available techniques to solve a particular problem.
- ➢ Planning of the work, preparation of graphs, bar (activity) charts and analyzing the results.
- ➢ Presentation - oral and written.

The evaluation is purely internal and will be conducted as follows:

Preliminary Report on progress of the work and viva marks	05
Final report	05 marks
Presentation and Defence before a departmental committee consisting of Head, a senior faculty and supervisor	15 marks