Kalinga University Atal Nagar (C.G.)

SCHEME OF EXAMINATION

& SYLLABUS

of

M.Tech Mechanical (Machine Design)

UNDER

Faculty of Engineering and Technology

w.e.f. Session 2021-22

Kalinga University, Raipur
Master of Technology (M.Tech) Mechanical
(Machine Design)
(2 yrs Programme) w.e.f 2021-22 Session

M.Tech in Mechanical(Design)						
Semester -I						
Code No.	**Paper**	**Lecture**	**T/P (Tutorial/Practical**	**End Semester Exam**	**Internal Marks**	**Total Marks**
MEDE101	Tribology	3	1	100	50	150
MEDE102	Mechanical Vibration	3	1	100	50	150
MEDE103	Advanced Dynamics of Machine	3	1	100	50	150
MEDE104	Theory of Elasticity & Plasticity	3	1	100	50	150
Refer Below Elective – I		3	1	100	50	150
MEDE105A	Optimization Techniques					
MEDE105B	Composite Materials					
MEDE105C	Analysis & Design of Pressure Vessels & Components					
MEDE106-P	Tribology Lab		5	30	20	50
MEDE107-P	Mechanical Vibration Lab		5	30	20	50
	Total	**15**	**15**	**560**	**290**	**850**
Semester - II						
Code No.	**Paper**	**Lecture**	**T/P (Tutorial/Practical**	**End Semester Exam**	**Internal Marks**	**Total Marks**
MEDE201	Finite Element Methods	3	1	100	50	150
MEDE202	CAD/CAM Application	3	1	100	50	150
MEDE203	Advanced Machine Tool Design	3	1	100	50	150
MEDE204	Advanced Mechanism	3	1	100	50	150
Refer Below Elective – II		3	1	100	50	150
MEDE205A	Experimental Stress Analysis					
MEDE205B	Measurement System Analysis					
MEDE205C	Computer Graphics & Visualization					
MEDE206-P	Finite Element Method Lab		5	30	20	50
MEDE207-P	CAD/CAM Lab		5	30	20	50
	Total	**15**	**15**	**560**	**290**	**850**

Semester - III						
Code No.	**Paper**	**Lecture**	**T/P (Tutorial/Practical**	**End Semester Exam**	**Internal Marks**	**Total Marks**
MEDE301	Robotics	3	1	100	50	150
MEDE302	Communication & Research Methodology	3	1	100	50	150
MEDE303	Fatigue & Creep	3	1	100	50	150
MEDE304	Preliminary Work on Dissertation			100	50	150
MEDE305	Seminar Based on Dissertation			100	50	150
	Total	9	3	500	250	750
Semester - IV						
Code No.	**Paper**	**Lecture**	**T/P (Tutorial/Practical**	**End Semester Exam**	**Internal Marks**	**Total Marks**
MEDE401	Dissertation			300	200	500
	Total			**300**	**200**	**500**

SEMESTER-I

MEDE101

Tribology

Unit-1

Introduction of Tribology, Contact of solids, Nature of Surface interaction, Types of friction, Theory of friction, Mechanism of Rolling friction, Friction instabilities. Wear and its mechanism, types of wear, Factor affecting wear, control of wear, wear test rig.

Unit-2

Lubricants: Properties, selection, Regime of lubrication, Lubricant test, solid lubricant Theory of Hydrodynamic lubrication, Reynolds Equation, Infinitely Long bearing , Infinitely short bearing.

Unit-3

Converging- diverging wedge, Summerfield Condition, Reynolds Condition, Center of pressure, Exponential film. Plane slider bearing, Raleigh step bearing.

Unit-4

Hydrodynamic Journal Bearing, Pressure equation, short bearing, Summerfield method for infinitely long bearings, viscous friction, Petrify 's Equation, cooling of bearing. Porous Bearing.

Unit-5

Hydrostatic lubrication, Foot step Bearing Hydrostatic Lift.
Elastohydrodynamic Lubrication, squeeze Film lubrication, rolling contact bearing.

Textbooks

- Fundamental of Tribology S.K.Basu, S.N.Sengupta-B.B.Ahuja-PHI
- Basic of lubrication Theory-A. Cameron-Wiley-Eastern Limited
- Tribology I.M.Hutching

Reference Books

- Theory & Practice of lubrication for engineer by fuller D.D.-John Wiley
- Engg. Tribology, Sahoo – PHI
- Theory of Hydrodynamic lubrication by Pinkus and Sternlicht B -Mcgraw Hill
- Introduction to Tribology of bearing by-B.C.Majumdar-AH Wheeler

MEDE102

Mechanical Vibration

Unit-1

Introduction –Degree of freedom, Linear and Non Linear Vibrations, Free and Forced Linear Vibration with and without damping Rayleigh's energy method, Whirling of rotating shaft, Vibration isolation, Transmissibility

Unit-2

Multi Degree of Freedom System Two degree and multi degree of freedom system, Principal modes, Influence coefficient, Lagrange's Equation, Generalized coordinates and generalized forces Vibration absorber

Calculation of natural frequencies by Rayleigh, Dunkerley, Rayleigh –Ritz, Stodala and Method of matrix iteration. Calculation of higher modes.

Unit-3

a) Vibration of Continuous system Transverse vibration of a string or cable, Longitudinal vibration of bar or rod
b) Torsional vibration of Shaft or Rod Single and Multi rotor system, Gear System, Branched System

Unit-4

Non-Linear Vibration

Introduction: Phase plane representation, Method of isoclines, Perturbation method, Application of Ritz method in Non Linear Vibration, Variable spring characteristics

Unit-5

Critical speeds of Shafts:
Introduction- Critical speeds of a light shaft having a single disc with
and without damping- Critical speeds of a shaft having multiple discs-Secondary Critical SpeedCritical speeds of a light cantilever shafts with a large heavy disc at its ends.

Transient Vibration: Introduction-Laplace transformation-Response to an impulsive input, Step input, Pulse input-phase Plane method-Shock spectrum

Text Books

- Theory of Vibration with Application –WT Thompson CBS Publisher (Pearson Education)
- Mechanical Vibration – S.S.Rao - Pearson Education.

✍✍ Mechanical Vibration – Meronvich-TMH Pub.

Reference Books

✍✍ Mechanical Vibration –Tse Morse and hinkle-PHS -Publication

✍✍ Vibration Problems in Engineering –S.Timoshenko & D.H.Young Affiliated East –West Press

✍✍ Mechanical Vibration –J.P.Denhartog Mcgraw Hill.

MEDE103

Advanced Dynamics of Machine

Unit-1

Dynamic Force Analysis: Plane motion mechanism, D'Alemberts Principle, Analysis of a floating link, Inertia Forces, The principle of Superposition, Planar rotation about a fixed center, Shaking force and moments.

Unit-2

Dynamic force Analysis: space Mechanism, Introduction, Measuring mass moment of inertia, Transformation of Inertia axes, Eulers equation of motion, Impulse and Momentum, Angular impulse and angular momentum.

Unit-3

Cam Dynamics: Forces in rigid systems, Mathematical models, Response of undamped cam mechanism-analytical method, Position error, Follower response by phase plane method, jump and cross over shock, Johnson's numerical analysis, Unbalance, spring surge and Wind up

Unit-4

Rotor Dynamics: Single Rotor and Multi Rotor system, balancing, Rotor dynamic consideration in design , critical speeds and unbalance response stability of rotors, vibrations of discs and blades.

Unit-5

Dynamics of Feed Back Control System: Examples of automatic control system, standard input functions, Analysis of proportional-error feed back system, Harmonic input, Stability, Types of controls, Nonlinear system.

Text Books

- Dynamics of Machines By Den Hartog
- Theory of Machines & Mechanism By J.E.Shigley & J.J.Vicker Jr.Mcgraw Hill

Reference Books

- Rotor Dynamics By J.S.Rao
- Kinematics & Dynamics of Machine By Martin McGraw Hill

MEDE104

Theory of Elasticity and Plasticity

Unit-1

Theory of Elasticity**:** Plane stresses and plane strain problems, Equations of equilibrium, Equations of compatibility, Boundary conditions. Stresses functions, Bihamonic Equations.

Unit-2

Two Dimensional Problems in Rectangular Coordinate: Saint Venants Principle, Solution by polynomials, Bending of Cantilever and simply supported beams.

Unit-3

Problems in Polar Coordinates: Stress distribution symmetrical about an axis, Bending of curved beams, Thick cylinder Rotating Solid and hollow discs, Rotating shafts and cylinder, disc of uniform strength, Shrunk fit assemblies of cylinder, stress concentration due to circular hole in a plate subjected to tensile load.

Unit-4

a) Bending of Plates: Rectangular Plate, Bending of axis –symmetric plate with different end conditions.

b) Torsion of Non Circular shafts: Saint Venants theory of rectangular shafts, Equilateral triangular shaft, Elliptical shaft, Torsion of hollow cross sections, Membrane Analogy

Unit-5

Theory of Plasticity**:** Introduction Saint Venants theory of plastic flow, yield criteria, plastic torsion of bars of circular cross section

Text Books

- Theory of Elasticity – S.P.Timoshenko &J.N.Goodier
- Theory of Elasticity - Dr.Sadhu Singh-Khanna Publishers
- Theory of Plasticity - Dr.Sadhu Singh –Khanna Publishers

Reference Books

- Advanced Mechanism of Solids – L.S.Shrinath, Tata McGraw -Hill
- Advanced Strength of Materials – Den Hartog
- Introduction to Theory of plasticity for Engineers-Hoffman and Sach
- Advanced Mechanics of Materials –Dr.Kamal Kumar and Dr.R.C.Gha
- Advanced Mechanism of Materials – Seely and Smith

Optimization Techniques

Unit-1

Introduction to optimization techniques: Basic Concepts, Constrained & unconstrained optimization problems. Functions of one variable, multivariable optimization with no constraints, Kubn tucker conditions, equality & in equality constraints. Applications of linear programming general design applications of optimization conventional Vs optimum design process, optimum design Problem formulation process.

Unit-2

Non-Linear Programming: Basic Concepts of Non Linear Programming, unimodal function, elimination methods, search techniques exhaustive & dichotomous search, golden section method. Interpolation methods -Quadratic & cubic. Unconstrained minimization methods, direct search method – random search method-random search method, patterned search method-rosam brocks method, descent methods – steepest descent method

Unit-3

Non linear Programming –constrained optimization techniques

Direct method-cutting plane method, gradient project method, indirect method –penalty finds method (Interior & exterior)

Unit-4

Geometrical & integer programming, Introduction unconstrained minimization & constrained minimization problems. Polynomial unconstrained minimization problem Integer linear & non-linear programming.

Unit-5

Stochastic Program & other topics in optimization stochastic linear & non-linear programming Introduction to optimum design with MAT LAB

Text Books

- Engg.Optimization theory & practice By S.S.Rao, New Age Pub
- Optimization Concepts & application in Engg.By A.D.Belegundu, Pearson

Reference Books

- Introduction to optimum design –J.S.Arora, Mcgraw Hill Pub.
- Practical Methods of Optimization –R.Flether, Wiley
- Optimization Theory & Practice –M.C.Joshi, Narosa Pub.

MEDE105B

Composite Materials

Unit-1
Classification and characterization of composite materials; fibrous, laminated and particulate composites; laminae and laminates; manufacture of laminated fibre – reinforced composite materials.

Unit-2
Macromechanical behaviour of laminar; stress-strain relations, engineering constraints for orthotropic materials stress-strain relations for lamina of arbitrary orientation. Strength and stiffness of an orthotropic lamina;

Unit-3
Bi-axial strength theories. Micromechanical behaviour of laminae; Rule of mixtures; Macromechanical behaviour of laminates

Unit-4
Single layered configurations, symmetric laminates, and anti-symmetric laminates, known symmetric laminates; Strength of laminates; Interlaminar stresses

Unit-5
Design of laminates. Buckling and vibration of laminated beams, plates and shells.

Text Books

- Composite materials: Design and application by Daniel Gay-et-al.

Reference Books

- Mechanics of composite materials By Richard M Christensen
- Introduction to composite materials design (Material Science & Engg.Series) By Barbero
- Composite Manufacturing Material, Product and Process Engg. By Sanjay Majumdar

MEDE105C

Analysis & Design of Pressure Vessels & Components

Unit-1
Basic principles: Elastic analysis of shells of revolution, membrane solutions, spherical and cylindrical shells, Junctions of shells of different geometry, Limit analysis, Shakedown.

Unit-2
Pressure vessel branches: Radial nozzle in spherical shell, stress concentration factors due to combined loadings, design methods to reduce SCF

Unit-3
Non-radial nozzles in spherical shells, Junction analysis of radial and non-radial nozzles in cylindrical shells. Pressure vessel ends: different design forms. Flanges:

Unit-4
Stress analysis and design methods. Local loading and local attachments: Supports design. Creep and fatigue in thin pressure vessels and its components. Pressure vessel design codes. Thick wall design:

Unit-5
Monoblock cylinders and spheres, multiplayer constructions. Pre-stressing of thick shells, shrink fit construction, wire and ribbon wound cylinders, Plastic radial expansion – autofrettaging. Thermal stress, creep and stress rupture; Dynamic and fatigue behaviour. Case studies: Vessels for special purposes. Computer aided design of pressure vessels

Text Books

- Theory & Design of Pressure Vessel By John F Harvey

Reference Books

- Pressure Vessel Design Manual By Dennis R.Moss

MEDE106-P

Tribology Lab

List of Experiments (to be performed at least 10 experiments)

1. To Study journal bearing apparatus.
2. To plot pressure distribution of hydrodynamic journal bearing at for a constant speed for a given SAE oil.
3. To compare the pressure distribution at constant speed for two different oil
4. To compare the pressure distribution of given SAE oil at two different speed.
5. To calculate the load carrying capacity of hydrodynamic bearing for a given oil at constant speed.
6. To find out the friction force and friction torque for hydrodynamic journal bearing
7. To study hydrostatic journal bearing.
8. To study the wear and lubrication testing machine
9. To study the wear characteristics of a lubricating oil on two different material.
10. To study the wear on a given metal for two different lubricating oil.
11. To study the change in viscosity of oil with change in temp.
12. To measure the viscosity of oil by different methods saybolt, Redwood)
13. To find flash point of lubricating oil
14. To find fire point of lubricating oil
15. To find the consistency of grease by Drop-can method

List of Equipments /Machine Required

1. Journal Bearing Apparatus
2. Hydrostatic journal bearing
3. Wear and Lubrication testing machine
4. Saybolt Viscosity measuring Apparatus
5. Redwood Apparatus
6. Consistency Apparatus

MEDE107-P

Mechanical Vibration Lab

List of Experiments (to be performed at least 10 experiments)

1. To determine radius of gyration of a body by using bi-filter suspension.
2. To verify Dunkerely for transverse vibration
3. Damped Torsional vibration of a body
4. To determine damping coefficient of single rotor system.
5. To find the node points and natural frequency of double (2) rotor system
6. To find the curve between frequency ratio and amplitude ratio for single degree of freedom system with spring and dashpot
7. To study the forced damped vibration of a simply supported beam at various amount of damping.
8. To calculate the whirling speed of a speed of a shaft with different end conditions and verify the results experimentally.
9. To study static and dynamic balancing machine
10. To study rithon phenomenon of Cam-Follower system.
11. To study the non-linear vibration of a pendulum system. (Simple)
12. To study the non-linear vibration of a compound pendulum system
13. To find natural frequency using accelerometer
14. To find natural frequency using vibrometer.

List of Equipments /Machine Required

Universal Vibration Apparatus

SEMESTER-II

MEDE201

Finite Element Methods

Unit-1

Basic steps in FEM formulation, Rayleigh Ritz method, Galerkins method, Von mises stress of generalization of the finite element concepts weighted reordal and variational approaches.

Unit-2

- ? 1-D Problems, basic functions and shape functions, Convergence Criteria h & p approximations, Natural Coordinates.
- ? Application of 1-D problems –plane trusses Three dimensional trusses

Unit-3

Two-dimensional problems, Constant strain triangles, isoparametric elements, sub-parametric super parametric numerical integration and others elements, Axis symmetric solids, single variable problems.

Unit-4

Beams and frames: Finite element formulation, boundary consideration, plane frames, three dimensional frames, Eigen value and time dependent problems, plane elasticity.

Unit-5

Three-dimensional problems in stress analysis, bending of plates non-linear material problems, direct solution technique creep, Computer implementation solution technique of FEM

Text Books

- ✍✍Introduction to finite elements in engineering by T.R.Chandrupatla & A.D.Belegundu (PHI)
- ✍ Introduction to the finite element method by C.S.Desai and J.F.Abdel
- ✍ Finite element Analysis –Theory and programming TMH BY C.S.Krishnamurthy

Reference Books

- ✍✍ Finite Element Analysis – P.Seshu PHI
- ✍✍ The finite element method in Engineering by S.S.Rao-Peragamon
- ✍✍ An Introduction to the finite Element method (MGH) by J.N.Reddy (TMH)

MEDE202

CAD/CAM Application

Unit-1
CAD/CAM contents and tools, History of CAD/CAM Development, Definition of CAD/CAM tools, Industrial look at CAD/CAM Hardware

Unit-2
CAD/CAM Software Introduction, Graphics Standards, Basic Definition, Software modules, Application of software in CAD/CAM.

Wire Frame models; Wire entities, Curve representation, and parametric representation of Analytical curves, parametric representation of synthetic curves. Curves manipulations, Design & Engineering applications.

Unit-3
Introduction, Surface model, Surface representation, Parametric representation of Analytic and synthetic surface Manipulations.

Solid Models, Solid Representations, Fundamentals of Solid Modeling, Half spaces, Boundary Representations, Constructive solid geometry, Sweep Representation, Analytic solid modeling

Unit-4
Geometric Transformations, Mechanical Assembly, Mass Property calculations, finite Element Modeling and Analysis.

Unit-5
Fundamentals of NC, CNC & DNC, Basics of NC Programming, NC Programming languages, Generation of Tool Path, Verification of tool path

Text Books

- Computer Aided Design and Manufacturing –M.P.Groover and E.W Zimmers, Prentice Hall, India

Reference Books

- CAD/CAM/CIM –P.Radhakrishnan and S.Subramnaiyam, New Age International
- Mathematical Elements of Computer Graphics –David. F.Rogers and J.Alan Adams, McGraw Hill.
- CAD/CAM Theory & Practice –Ibrahim Zeid –Tata Mcgraw Hill Pub.

MEDE203

Advanced Machine Tool Design

Unit 1

Theory of Metal Cutting:

?? Cutting Tools – Types, Materials tool geometry of single point cutting tool.
?? Chip Formation – Deformation, yielding, shear plane and shear plane angle, velocity relationship.
?? Orthogonal and oblique cutting, force system during oblique cutting.
?? Merchants Theory of metal cutting, calculation of stresses and strain in the chip.
?? Tool Wear – Factors affecting tool wear, types of tool wear, face wear, flank wear and nose wear.
?? Tool life, Taylor's tool life relationship.

Unit 2

Design of speed and feed gearbox:

?? General requirement of machine tool design, engineering process applied to machine tool.
?? Design of speed gear box – Aims of speed regulation, stepped and stepless drive, intermediate spindle speeds, speed diagram, structural (Ray) diagram, speeds in G.P., kinematic arrangement of gears, calculation of number of teeth, deviation diagram.
?? Design of speed gear b ox for 6, 9 and 12 speeds for lathe.
?? Design of feed fear box – Purpose of feed motion, types of feed drives, feed in drilling machine, milling machine, feed in lathe.
?? Design of longitudinal and cross feed drive for lathe machine, cutting BSW and matric threads on lathe.

Unit 3

Strength and rigidity of machine tool structures

c) Basic principles of design for rigidity, effect of hollow section on rigidity, methods for improving rigidity.
d) Design of lathe beds for bending and torsion reinforcing stiffeners in lathe beds.
e) Design of pillar drill columns.
f) Design of Radial drill columns.
g) Model technique in design of machine tool structures.

Unit 4

Design of machine tool slide ways:

?? Purpose and shapes of slide ways material of bed and guides, features of construction.
?? Design of guides for centre lathe, force analysis of lathe guide ways, pressure distribution on guide ways.
?? Design of hydrostatic guide ways.
?? Design of aerostatic guide ways.Design of anti-friction guide ways – ball and roller type, protecting devices for guide ways.

Unit 5

Vibration in machine tools:

1) Vibration measuring instruments – Introduction, Transducers – Classification, sensitivity, Dynamic response, piezo-electric transducers.

2) Inductive type pickups, variable reluctance pickups, capacitive pickups, vibrometer, accelerometer.

?? Vibration in machine tools, sources, transmission of vibration.

?? Machine tool chatter and dynamic instability, chattu in lathe, stability chart.

?? Analysis of machine tool structure for their dynamic characteristic – flexibility method, F.E.M. method.

Books Recommended:

Text Books

- Principles of metal cutting – G.C.Sen & A. Bhattacharya (Vol.I)
- Principles of machine tools - G.C.Sen & A. Bhattacharya
- Machine tool design – N.K.Mehta

Reference Books

- Mechanical Measurement – T.G.Beek & N.L. Beek (Addison Wesley Pub. co.)
- Measurement Techniques in mechanical engineering – R.J.Sweeney (John Wiley & Sons)
- Machine tool vibration – S.A.Tobias (John Wiley & Sons)

MEDE204

Advanced Mechanism

UNIT-I

Kinematics of Mechanisms: Kinematic analysis and synthesis of Mechanism, Chebyshev spacing of precision points, Overlay Methods, Blach's Synthesis method, Freudensteins method, Design of crank lever mechanism for specified angles.

UNIT-2

Coupler Curves: Definition and equation, Roberts Law, Coupler curves from 5-bar mechanism, Design problems, Cognate of slider crank, Double points of a coupler curve.

UNIT-3

Curvature Theory: Eulers Savary equation –graphical solution, Hartmann construction, First and second Bobillier construction, Cusp points, Inflection circle for a four bar mechanism, Design of a four bar mechanism for specified angular velocities and acceleration of cranks. Cubic of stationary curvature.

UNIT-4

Analytical Design of 4- Bar Mechanism

Freudenstein's Equation, Sample design problem – three coordinated crank positions, Design for constant angular velocity ratio of cranks, Fourth order design of 4-bar mechanism to generate log function, Choice of precision points, Higher order approximation

UNIT-5

Forces in mechanisms - Free body diagrams - Friction in link connections - Forces in linkages.

Cam dynamics - Forces in rigid systems, Mathematical models, Response of a uniform - Motion undamped cam mechanism - Analytical method, Follower response by phase - Plane method - Position error, Jump, Crossover shock - Johnson's numerical analysis.

Text Books

- Kinematic & Linkage Design –Allen S Hall Jr – PHI
- Advanced Mechanism and Design (Analysis & Synthesis) –Gorge N Sandal & Arthur G Erdman-PHI

Reference Books

- Mechanism & Machine Theory – J.S.Rao&R.Dukkipati, Wiley-Easten
- Analysis of Four Bar Linkage –J.A.Hornes &G.L.Nelson, John Wiley

MEDE205A

Experimental Stress Analysis

Unit-1
Basic elasticity theory, Analysis of Stress and Strain, Plane stress plane strain problems, Equation of Equilibrium, Equation of Compatibility, Boundary Condition

Unit-2
Strain Measurement Methods: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits, transducer applications, Recording instruments for static and dynamic applications.

Unit-3
Photo elasticity: Theory of photo elasticity, Analysis techniques, three dimensional photo elasticity, Reflection Palanscope and application.

Unit-4
Brittle coating methods of strain indication.

Moire Method of strain analysis.

Unit-5
Grid method of strain analysis
Computer interfacing and on-line monitoring of strain and stress fields.

Text Books

- Experimental Stress Analysis by E.S.A.Dally & Rolly

Reference Books

- Experimental Stress Analysis –Sadhu Singh
- Experimental Stress Analysis – Adel Mubeen

MEDE205B

Measurement System Analysis

Unit-1

- Analysis of Measurement:
- Classification of Measurement, Analysis of Experimental data, Types of measurement errors, Uncertainity analysis, Propagation of uncertainty and Curve fitting

Unit-2

- Static & Dynamic Characteristics:
- Measurement system variations, static performance, characteristics, linearity, Static sensitivity, Repeatebility, Hysteris threshold resolution, Redability and span, Dynamic Characteristic

Unit-3

- Direct, Indirect & Combined Measurement:
- Direct Measurements, Relationship between single and multiple measurement, Estimation of elementary errors, Calculation of uncertainty in multiple measurements, Indirect Measurements, Correlation coefficient and combined measurement, Measurement with linear equality and inequality

Unit-4

- Data analysis:
- Data acquisition and processing: Types and configuration of DAS, Signal conditioning, A/D, D/A conversions, Electro-optical devices, piezoelectric transducer, photo elastic, brittle coating and Moire Fringe stress –analysis techniques.

Unit-5

- Theory of Calibration
- Types of Calibration, Estimation of Measement Instruments in Verification, Rejects of verification and ways to reduce their number, calculation of a necessary number of standards.

Text Books

- Mechanical Measurement – Buck & Beckwith - Narosa Publishing House

Reference Books

- Measurement system – Ernest O Doeblin – Tata Mc Graw Hill 1994

✍✍ Experimental Methods for engineers, Hallisman, Tata McGraw Hill
✍✍ Engineering Experimentation –Doeblin, Tata Mcgraw Hill
✍✍ Measurement Errors and Uncertanities-Semyon G. Rabinvich-AIP Press Pub.
✍✍ Measurement & Metrology – A.K.Shawney & M.Mahajan

MEDE205C

Computer Graphics & Visualization

Unit-1

- Raster graphics and volume graphics. Video basics. Display devices and interactive devices; 2-D and 3-D graphics primitives.
- Clipping in 2-D and 3-D; Generation and projection of 3-D wire frame solid models, polygonal models. Space curves and surface models.

Unit-2

Intersection of surfaces and blending; hidden line and hidden surface elimination algorithms; Ray-surface intersection and inverse mapping algorithms. Ray tracing for photo realistic rendering. Illumination models. Shading, Transparency, Shadowing and Texture mapping; Representation of colours.

Unit-3

Visualization of experimental and simulated data. Surface construction from scattered data, 3-D data arrays and 2-D cross sections. Elevation maps, topological maps, contour maps and intensity maps; fractals for visualization of complex and large data sets.

Unit-4

Algebraic stochastic and Geometric fractals. Modeling of natural forms and textures using fractals; Visualization of multi variate relations. Flow visualization and hyper streamlines; Visualization of Meteorological, cosmological, seismic, biological data for scientific decision making.

Unit-5

Animation. Modeling issues in dynamic visualization. Behavioral animation; walk through – coordinate transformation and view transformation; virtual reality interfaces. Interactive and immerse systems for Prototyping and visualization; Visualization in concurrent engineering. Interactive multimedia technology and standards for Video-Graphics -Audio integration and tele-video conferencing.

Text Books

- Computer Graphics By Krishnamoorthy TMH

Reference Books

- Computer Graphics a Program Approach By Harrington
- Computer Graphics By Hearn & Baker

MEDE206-P

Finite Element Methods Lab

Experiments to be performed

1. Use and Application of Ansys and Pro-E for different types of problem related to theory of elasticity and hydrodynamic lubrication, mechanism, vibration, structure, Hydrostatic
2. Static stress analysis of wall bracket.
3. Steady state thermal analysis of circular tank and pipe assembly.
4. To perform stress analysis of 2D truss using ANSYS
5. To generate a C program to calculate stresses in a tapered shaft using FEM.
6. To generate a C program to make analysis of 2D truss using isoparametric elements in FEM.
7. to generate a C program to analyse temperature distribution in a one dimensional heat flow model
8. To use preprocessor in ANSYS to generate & mesh a model using various elements in FEM.
9. To use postprocessor in ANSYS to generate stress analysis results.
10. To analyse stress in a crane hook using ANSYS.
11. Stress analysis of leaf spring using Von Mises theory in ANSYS.
12. To perform dynamic stress analysis of connecting rod using ANSYS.

MEDE207-P

CAD/CAM Lab

Experiments to be performed

1. Creating Sketches in Sketching environment in CAD, Using PROE,
2. Solid Modelling-I using PROE(WF2.0).Tools like Revolve,Extrude.
3. Advance Solid ModellingI using PROE(WF2.0),Tools like Sweep,Blend,Spline Etc
4. Use of solid Modelling Edit Tools like hole,pattern,chamfer,round,fillet etc.
5. Assembly Modelling of pedestal Bearing.
6. To create drawing views of part model of a connecting rod.
7. To create a surface model of Telephone receiver/Scroll Mouse.
8. To Generate CNC Program for slot cutting in Aluminium workpiece using Master Cam on CNC Milling.
9. To Generate CNC program to drill a hole for pocketing in aluminium workpiece using Master CAM on CNC Milling
10. To simulate stress distribution in a cantilever steel beam using PRO-MECHANICA.
11. To perform part Manufacturing using PROE& MECHANICA.
12. To perform one dimensional steady state Thermal Analysis of Clutch plate.
13. To perform Stress Analysis in Dummy Axle.

SEMESTER-III

MEDE301

Robotics

Unit-1

Roboti

cs

Basic concepts in Robotics: Advances and application and application of robotics in Robots, Resolution, Accuracy and Repeatability, Point Continues part system control loops, types of manipulators, wrist & Grippers.

Unit-2

Kinematic Analysis of Robotics

Geometry based direct kinematics, Co-ordinate and vector transformation using matrix, Denant-Hartenberg Conversion, application of DH notation, Inverse Kinematics.

Unit-3

Robot –An Dynamics: Elementary treatment of Lagrange –Euler, Newton – Euler formulations, Generalized D'Alembert equation of motion.

Unit-4

Drives, Control of Trajectory: Hydraulic system stepper motor, Direct current servomotors, A-C servomotors, adaptive control, interpolars, trajectory planning, resolved motion rate control methods.

Unit-5

Robot Programming: Robot languages: AL, AML, RAIL, RPL, VAL, Demonstration of points in space: Continuous path (CP), Via points (VP), Programmed points (PP).
Robot Languages: Textual robot Janguages, Generation, Robot language structures, Elements in function.

Books Recommended:

Text Books

- M.P.Groover, M.Weiss, P.N.Nagal and N.G.Odrey, Industrial Robotics, Mcgraw Hill International Deduction, 1986
- K.S.Fu, R.C, Gonzaler C.S.G.Lee, Robothes (Control, Sensing vision & intelligence)

Reference Books

- Shimon Y.Nof (Editor) handbook of industrial robotics, John wiley and sons, 1985
- Fu K.S. , Gonzalez R.C and Lee C.S.G., Robotics : Control sensing vision and intelligence ,Mcgraw Hill ,1987
- D.T.Pham, Expert –System in Engineering, Springer Verlog, 1988
- Anthony C.McDonald, Robot Technology, theory, design and applications Prentice Hall, New Jersey 1986
- Yoren Koren, Robotes for Engineers.

MEDE302

Communication and Research Methodology

Unit 1

Concepts of Communications: Definition, Forms of Communication, Objectives of Communication, Characteristics of Communication, Process of Communication, Communication, Roadblocks, Role of Verbal and Non-verbal Symbols in Communication, Barriers to Effective Communication, Overcoming Communication Barriers.

Nonverbal communication: Body Language, Gestures, Postures, Facial Expressions, Dress codes; the Cross Cultural Dimensions of Business Communication; Listening and Speaking, techniques of electing response, probing questions, Observation. Business and social etiquettes;

Listening Skills: Definition, Anatomy of poor Listening, Features of a good Listener, Role Play, Group Discussion and Interviews, Meetings: Ways and Means of conducting meetings effectively, Mock Meetings and Interviews

Unit 2

Reading and language skills: The reading process, purpose, different kinds of texts, reference material, scientific and technical texts, active and passive reading, strategies - vocabulary skills, eye reading and visual perception, prediction techniques, scanning skills, distinguishing facts and opinions, drawing inferences and conclusions, comprehension of technical material - scientific and technical texts, instructions and technical manuals, graphic information.

Forms of Communication in Written mode: Basics Body language of Business Letters and Memos, Tone of writing,

Enquiries, orders and replying to them, sales letters, Job applications and resume, E-mail: How to make smart e-mail, Writing Business Reports and Proposals, Practice for Writing.

Unit 3

Referencing and Writing skills: Business letters: Enquiries, Circulars, Quotations, Orders, Acknowledgments, Executions, Complaints, Claims and adjustments, Collection letter, Banking correspondence, Agency correspondence, Bad news and persuading letters, Sales letters, Job application letters - Biodata, Covering Letter, Interview Letters, Letter of Reference, Memos, minutes, Circulars & notices.

Types of Business Reports - Format, Choice of vocabulary, coherence and cohesion, paragraph writing, organization reports by individual, Report by committee.

Unit 4

Introduction to Research and Research Design: Nature and scope of research, information based decision making and source of knowledge. The research process; basic approaches and terminologies used in research. Defining research question and framing of hypotheses, preparing a research plan, qualitative and quantitative research designs, Experimentation, Observational studies, Exploring secondary data.

Measurement and Scaling, Data Source and Data Collection Field research: primary data collection from observations, surveys and experimentation. Measurement and scaling; commonly used scales in reliability and validity of scales. Designing instrument for data collection; testing the instrument, data collection process, Sampling methods and procedures and sample size decisions.

Unit 5

Data Analysis and Presentation Editing and coding of data, tabulation, graphic presentation of data, cross tabulation, Testing of hypotheses; type I and II errors, one tailed and two tailed tests of significance, Parametric and nonparametric tests for Univariate and Bivariate data. Tests of association; simple linear regression and other non parametric tests.
Technical Writing: Technical Proposal writing: Definition, Purpose, types, characteristics, Elements of structure, style and appearance, evaluation, exercises, Research report writing, Proposal writing, referencing, forms of reports, bibliography, etc. Research paper, Dissertation, and Thesis, Instruction Manuals, Type of instructions, Writing Instructions, Technical Descriptions, Process descriptions, Guidelines for Writing Good Descriptions.

Text Books:

1. Lesikar, R. V. & Flatley, Basic Business Communication Skills for Empowering the Internet Generation. TMH.
2. Meenakshi Raman, Sangeeta Sharma, Technical Communications, Oxford Latest Edition.
3. D. K. Bhattacharyya, Research Methodology, Excel Books 2nd Edition.

Reference Books:

1. Bowman, J.P. &Branchaw, P.P. Business Communications, Process to Product Dryden Press, Chicago.
2. M Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill.
3. E. H. McGrath, Basic Managerial Skills, Prentice hall India
4. Sajitha, Technical Writing, Himalaya Latest Edition

Fatigue & Creep

Unit-1

Design Against Fatigue: Factors affecting fatigue behaviour, Environmental superimposed static stress, Gerber parabola, Modified Good man diagram, Concentration, Notch sensitivity, Cumulative fatigue damage, Linear damage Practical measure to combat fatigue. Loading in finite /life range effects, Influence of Sadenburg line, Stress rule, Miners Equation,

Unit-2

Design Against Fracture: Stress intensity, factor of a crack in finite bodies, fracture criteria, Fracture toughness, Fatigue crack propagation, Plastic deformation, Plastic deformation around crack tip, Crack opening displacement, Design of steam, turbine rotors, Rotor discs, Design of thin walled pressure vessels and pressure piping,

Unit-3

Design Against Creep: Creep of solids, Creep phenomenon, Parameter methods, Larson Miller Parameter, herby Dorn parameter, Manson Hafford parameter, Creep under biaxial stress, Materials for application at elevated temperature

Unit-4

Surface Failure: Surface geometry, Mating surfaces, Different types of wears -Adhesive, Abresive, Corosion, Pitting, spalling: Contact pressure in spherical contact, Stress distribution in spherical contact, Stresses in ball and thrust bearing Cylinder contact stresses, Stresses in cam and follower, Surface fatigue strength.

Unit-5

Design for reliability: Introduction Probabilistic approach to design, Design for reliability, Failure mode and effects analysis, Design for safety

Text Books

- ✍✍ Mechanical Engineering Design – Joseph E Shigley & Charles R Mischke
- ✍✍ Engineering Design – George E Dieter (McGraw Hill)

Reference Books

- ✍✍ Advanced Machine Design – A Mubeen (Khanna Publisher)
- ✍✍ Machine Design – Robert L Norton (Pearson Education)

MEDE304

Preliminary work on Dissertation

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports.

MEDE305

Seminar Based on Dissertation

The student will deliver a seminar on the topic chosen by him and approved by Departmental committee for evaluation at the end of semester.

Semester – IV

MEDE401

Dissertation

The student will submit a detailed Project Report on the topic approved by Departmental committee in a specified format and will also deliver a Presentation on the topic chosen at the end of semester.