

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND EXAMINATION
M.TECH. (Mechanical Engineering) SYLLABUS 2012-13
CORE COURSES
First Semester

S. NO.	COURSE NO.	COURSE TITLE	TEACHING SCHEDULE			Marks Weightage	
			L	T	P	Theory	Sessional
1	ME- 501	Numerical Methods & Computing	3	-	-	100	50
2	ME- 502	Micro Machining Processes	3	-	-	100	50
3	ME- 503	Computer Aided Design and Manufacturing	3	-	-	100	50
4	ME- 504	Advanced Mechanics of Solid	3	-	-	100	50
5	ME-505	Welding Technology and Non Destructive Testing	3	-	-	100	50
						External	Internal
6	ME-531	CAD/CAM Lab	-	-	2	25	25
7	ME-532	Numerical Methods & Computing Lab	-	-	2	25	25
8	ME- 533	Welding Technology Lab	-	-	2	25	25
Total						575	325

NOTES:

In the semester examination, the examiner will set eight questions in all entire syllabus & students will required to attempt only 5 questions .The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

Second Semester

S. NO.	COURSE NO.	COURSE TITLE	TEACHING SCHEDULE			Marks Weightage	
			L	T	P	Theory	Sessional
1	ME-506	I.C. ENGINES COMBUSTION AND POLLUTION	3	-	-	100	50
2	ME-507	Total Quality Management	3	-	-	100	50
3	ME-508	Modeling & Simulation	3	-	-	100	50
4		Elective-I	3	-	-	100	50
5		Elective-II	3	-	-	100	50
6	ME-535	Advance Production Lab	-	-	2	External	Internal
						25	25
7	ME-536	Mechatronics Lab	-	-	2	25	25
		Total				550	300

NOTES:

In the semester examination, the examiner will set eight questions in all entire syllabus & students will required to attempt only 5 questions .The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

Third Semester

S. NO.	COURSE NO.	COURSE TITLE	TEACHING SCHEDULE			Marks Weightage	
			L	T	P	Theory	Sessional
1	ME - 601	Advanced Kinematics & Dynamics of Machines	3	-	-	100	50
2	ME - 602	Advanced Metrology & Calibration	3	-	-	100	50
3		General Elective	3	-	-	100	50
4	ME-611	Project**			10	100	100
5	ME-612	Seminar			2		50
6	ME -613	METROLOGY LAB			2	External	Internal
						25	25
		TOTAL				425	325

NOTES:

In the semester examination, the examiner will set eight questions in all entire syllabus & students will required to attempt only 5 questions .The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

Elective-I

- ME-521 Method Engineering & Ergonomics
- ME-522 Jigs & Fixture
- ME- 523 Computational Fluid Dynamics

Elective-II

- ME-524 Advanced Operation Research
- ME-525 Tool & Die Design
- ME-526 Machine Tool Design

General Elective

- ME-621 Rapid Prototyping

ME-622 Computer Integrated Manufacturing Systems
 ME -623 Design of Experiments & Research Methodology

Project should be a detailed study followed by verification of a research papers published in an international journal of repute (from last 5years) or Simulation/Modeling of an existing problem or a design and investigation or a demonstrable experimental work of any contemporary problem.

Fourth Semester

Sr. No.	Subject Code	Subject Name	L	T	P	External		Internal	
1	ME- 614	Dissertation	-	-	24	400		100	
		TOTAL				400		100	

**M.D. University, Rohtak (Haryana) Scheme of
Studies & Examination for
Master of Technology in Mechanical Engineering**

The performance of the students of M.Tech (Mechanical Engineering) Course shall be graded on the basis of percentage of marks and corresponding grades as mentioned below :

A)

Marks	Grade	Marks
85 ≤	A+	100 ≤
75 ≤	A	85 <
65 ≤	B	75 <
50 ≤	C	65 <
40 ≤	D	50 <
00 ≤	E	40 <
Letter Grades	Performance	Division
A+	Excellent	First
A	Very Good	First
B	Good	First
C	Fair	Second
D	Pass	Third
E	Repeat	Fail

Note :

The candidate who have passed all the semesters examination in the first attempt obtaining at least 75% marks in aggregate shall be declared to have passed in the first division with Distinction mentioned in the degree.

- B) Actual percentage of Marks Obtained and Corresponding grades should be mentioned on detailed marks certificate of student. To obtain 'D' grade a student must have secure at least 40% marks in each subject of the semester Examination.
- C) Student who earned and 'E' grade or less than 40% marks in any subject shall have reappear in that subject.

NUMERICAL METHODS AND COMPUTING
ME-501

L 3	T -	Sessional marks: 50 Theory marks: 100 Durations of exam: 3 hrs
UNIT-I	ERRORS IN NUMERICAL CALCULATIONS	Introduction. Numbers and their accuracy. Absolute. Relative and percentage errors and their analysis General error formula.
UNIT-II	INTERPOLATION AND CURVE FITTING	Taylor series and calculation of functions. Introduction to interpolation. Lagrange approximation. Newton polynomials. Chebyshev polynomials least squares curve fitting. Interpolation by spline function
UNIT-III	NUMERICAL DIFFERENTIATION AND INTEGRATION	Approximating the derivative. Numerical differentiation formulas. Introduction to Numerical quadrature. Newton-Cotes formula. Gaussian quadrature.
UNIT-IV	SOLUTION OF NONLINEAR EQUATIONS	Bracketing methods for locating a root. Initial approximations and convergence criteria. Newton-Raphson and secant methods. Solution of problems through a structural programming language such as C or Pascal.
UNIT-V	SOLUTION OF LINEAR SYSTEMS	Direct Methods. Gaussian elimination and pivoting. Matrix inversion. LU factorization. Iterative methods for linear systems solution of problems through a structured programming language such as C or Pascal.
UNIT-VI	EIGEN VALUE PROBLEMS	Jacobi. Givens and Householder's methods for symmetric matrices. Rutishauser method for general matrices, power and inverse power methods solution of problems through a structured programming language such as C or Pascal.
UNIT-VII	SOLUTION OF DIFFERENTIAL EQUATIONS	Introduction to differential equations. Initial value problems. Euler's methods. Heun's method. Runge-Kutta methods. Taylor series method. Predictor-corrector methods. Systems of differential equations. Boundary

value problems. Finite-difference method. Solution of problems through a structured programming language such as C or Pascal.

UNIT-VIII PARTIAL DIFFERENTIAL EQUATIONS

Solution of hyperbolic. Parabolic and elliptic equations. The eigenvalue problem the power method and the Jacobi's method for eigen value problems. Solution of problems through a structured programming language such as C or Pascal.

Text Books:

1. Applied Numerical Analysis by Curtis E. Gerald and Patrick Q. Wheatley- published by Addison Wesley.
2. Applied Numerical Methods- Carnahan, B.H. Luther, H.A. and Wilkes, J.O. Pub-j. Wiley, New York

Reference Books:

1. Numerical Solution of Differential Equations. By M.K.Jain. published by Wiley Eastern, New York.
2. Introductory Methods of Numerical Analysis by S.D. Sastry. Published by Prentice Hall of India.
3. Numerical Methods- Hornbeek, R.W. Pub-prentice Hall, Englewood Cliffs, N.J.
4. Numerical Methods for Mathematics. Science and Engineering by John H.Mathews. PHI New Delhi

MICRO-MACHINING PROCESSES

ME-502

L T
3 0

Sessional marks: 50
Theory marks:100
Durations of exam: 3 hrs

UNIT-I

Introduction to New Machining Technologies: Micro electromechanical Systems (MEMS), Non Conventional Machining Process, Comparison of conventional machining processes and new technologies.

UNIT-II

Micro-electro-mechanical System Description, System Process, MicroElectromechanical systems paradigms, Materials for MEMS, Future trends: Mechanical Transducers, Optical Transducers, and Multi Disciplinary Applications.

UNIT-III

Ultrasonic machining, Whirling jet machining, fundamental principles, process parameters characteristics, tool design, metal removal rate analysis, important part design, analysis of process. Machining Accuracy and Surface Finish Optimization.

Electro Chemical Machining- Introduction, principles, scheme, process parameters, metal removal rate, Electrochemical grinding: Introduction, tools, process parameters, metal removal rate, Honing, Accuracy and Surface finish Optimization.

UNIT-IV

EDM- Introduction – basic principles, metal removal rate, machining accuracy and surface finish optimization, selection of tool material and dielectric, analysis of process. Wire electric discharge machining: Principle, Process variables.

Reference Books:

1. Manufacturing Sciences by Ghosh & Malik.
2. Newer machining processes; H.S.Shan
3. Advance machining processes by B. Bhushan
4. Fundamentals of Micro-machining by M.J Madou CRC Press.

**COMPUTER AIDED DESIGN AND MANUFACTURING
ME-503**

L T
3 0

Sessional marks: **50**
Theory marks: 100
Durations of exam: 3 hrs

UNIT-I

Introduction :Introduction, Review of vectors & Matrices, Basics of geometric and solid modeling, explicit, implicit, intrinsic and parametric equations, coordinate systems. Transformations : Introduction , Transformation of points & lines,2-D Translation , Shearing, Rotation , Reflection, Scaling & Combined Transformation, Homogeneous Co-ordinates, 3- D Scaling, Shearing, Rotation , Reflection & Translation, Combined Transformation, orthographic , axonometric, oblique & perspective projections.

UNIT –II

Curves & Surfaces Geometry and topology, Algebraic & geometric forms of straight lines, circle, bezier curves & B – splines curves, blending functions, Reparametrization, plane surfaces, sixteen point forms, four curves form, ruled surfaces of revolution, Tabulated cylinder, lofted surfaces, bi-cubic surfaces, bezier surfaces, B-splines surfaces, Coons patch.

UNIT –III

Introduction to CAM, Computer Hardware & Software, APT Language, Introduction to NC, CNC & DNC Systems, Convention of Machine axis and coordinate systems. CNC tooling Machine Tools. Automatic tool changers. Open loop and closed loop systems. Adaptive control encoders.

UNIT-IV

Manual part programming, CNC part programming, canned cycles, G-codes & M-codes. High language programming: Flexible manufacturing systems, Computer aided process planning, and Automated Material handling.

Text Books:

1. CAD/CAM by M.P. Groover, PHI
2. CAD/CAM Theory and Practice, Teid
3. Understanding CAD/CAM by D.J. Bowman

Reference Book:

1. CAD/CAM Handbook, tieholz
2. Computer Aided Manufacturing, P.N. Rao.

ADVANCED MECHANICS OF SOLIDS

ME-504

L T
3 0

Sessional marks: 50
Theory marks : 100
Duration of exams: 3 hrs.

Unit-1 Analysis of stress. Analysis of strain. Compatibility conditions. Generalized Hooke's law. Stress-strain relations. Theories of failure. Factors of safety in design. Ideally plastic in solids. Yield surfaces of Tresca and von Mises. Prandtl-Reuss and Saint Venant-Mises equations.

Unit-2 Energy methods in first and second theorems of Castigliano. Maxwell-Mohr integrals. Asymmetric bending of beams. Shear centre. Bending of curved beams and thick curved bar shear center.

Unit-3 Bending of a plate. Bending of a uniformly loaded rectangular plate. Deflection of a long rectangular plate with initial curvature. Bending of a circular plate with various loading conditions.

Unit-4 Torsion of circular and non circular bars. Torsion of rolled section bars. Membrane analogy. Torsion of thin walled tubes. Torsion of rolled section bars. Torsion of thin walled multiple – closed section. Centre of twist and flexural centre.

Unit-5 Thick walled cylinder subject to internal and external pressure. Stresses in composite tubes. Stress in rotating disks, shafts and cylinders. Thermal stresses in thin circular disc. Long circular cylinder. Sphere and straight and curved beams.

Unit-6 Elastic stability. Beam-columns with concentrated load. With several concentrated load with end coupled. Buckling problem as eigen value problem. Orthogonality relations. Energy methods for buckling problems.

Reference books

1. Srinath I.S. "Advanced Mechanics of solids". Tata McGraw Hill 2002
2. Timoshenko. S. "Strength of Materials part-II Advanced theory and problems." Third Ed. First Indian Ed. CBS 1986.
3. Popov. Egor P. "Engineering Mechanics of Solids". Second Ed. Pearson 1998.
4. B. B. "Strength of Materials part-II
5. Xu Zhilum "Applied Elasticity" New Age.
6. Craig. "Mechanics of Materials" Second Ed. John Wiley 1999.
7. Raju N. Krishan and Gururaje. "Advanced Mechanics of solids and Structures"

**WELDING TECHNOLOGY AND NON DESTRUCTIVE TESTING
ME-505**

L T
3 0

Sessional Marks 50
Theory Marks 100
Durations of exam:3 hrs

UNIT-I

Review of conventional welding processes: Importance and application of welding, gas welding, arc welding, TIG, MIG, submerged arc welding, electroslag welding, resistance welding.

Advanced/Unique welding processes: laser beam welding, electron beam welding, friction welding cold pressure welding, ultrasonic welding, diffusion welding.

UNIT-II

Weld design: Weld design, weld defects, distortion and remedies, welding stresses: cause and development of residual stresses, method of controlling and relieving residual stresses in weldments. Testing of welds: tensile, impact, hardness, and corrosion.

Thermal and metallurgical consideration: Thermal consideration of welding temperature distribution, heating and cooling curves. Solidification of weld, weld zones, heat affected zone and parent metal, macro & micro structure, Hydrogen embrittlement and cracking, weld cracking, hot and cold cracking.

UNIT-III

Non-destructive testing: Introduction, in-situ metallography, dye penetrant flaw detection, application & limitation. Ultrasonic testing; advantages, disadvantages, applications, generation and characteristic of ultrasonic waves, methods and instruments for testing.

Radiographic methods: Principal, sources of radiation: X-rays, gamma rays recording of radiations, limitation and radiation safety.

UNIT-IV

Magnetic and electrical methods: advantages, limitations, method of generating magnetic fields, magnetic particle testing; method and limitation. Eddy current testing method, potential drop methods, application and limitations.

Other methods: Acoustic emission methods, leak detection, thermal inspection. Non-destructive inspection of welds: porosity, blowholes, inclusions, cracks.

Text Books:

1. Welding Technology by R.S.Parmar
2. Welding Technology by O.P. Khanna
3. Welding Science & Technology by md. Ibrahim Khan
4. Non-Destructive Testing by P. Halmshaw
5. Practical Non-destructive Testing by Baldev Raj, T. Jayakumd, M.. Thavasamutha
6. Non-destructive Testing of welds Baldev Raj, C.V. Subrananuam, and T.Jayakumar

Reference Book:

1. The metallurgy of welding by lancster ,George Allen.
2. Metal handbook, vol 6 ,73,ASME.
3. Welding and welding technology by Richard L. Little.

CAD/CAM LAB
ME-531

P
2

Theory Marks : 25
Sessional Marks: 25
Durations of exam :3 hrs

LIST OF EXPERIMENTS

1. To create a 2-Dimensional Sketch with the help of all geometrical Shapes.
2. To list the coordinate of given diagram
3. To prepare a part programme for facing & turning operation on a CNC Lathe.
4. Prepare part programme for facing & taper turning operation on CNC Lathe in single cut programming in word address format.
5. To create a solid with all of all solid entities of basic solid modeling commands.
6. Practice Boolean operation on solids.
7. Create surface with help of ruled & the tabulated surfaces.
8. Create a surface with the help of a surface of revolution & edge surface.

NUMERICAL METHODS AND COMPUTING LAB
ME -532

P	Theory Marks	25
2	Sessional Marks	25
	Durations of exam	:3 hrs

The students will be required to carry out the following exercises, that are' based on the theory course ME-501 Numerical Methods and Computing, with the help of MATLAB software/Pascal/C/C++ on personal computer.

1. Solution of Non-linear, equation in single variable using the method of successive bisection.
2. Solution of Non-Linear equation in single variable using the Newton Raphson. Secant. Bisection and Modified Euler's method.
3. Solution of system of simultaneous algebraic equations using the Gaussian elimination procedure.
4. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method.
5. Numerical solution of and ordinary differential equation using the Euler's method.
6. Numerical solution of an ordinary differential equation using the Runge- Kutta 1th order method.
7. Numerical solution of or ordinary differential equation using the Predictor-corrector method.
8. Numerical solutions of Elliptic. Parabolic and llyperbolic partial differential equistions using the method of Finite Difference.

WELDING LAB
ME- 533

L T P
- - 2

Sessional : 25 Marks
Theory : 25 Marks
Duration of Exam : 3 Hrs.

List of Experiments in Welding

1. To study Heat flow in Welding
(Equipment for use-Gas Welding equipment)
2. To study Bead Geometry, Hardness of Bead, Micro structure of welding Bead in case of:
 - i) MIG Welding ii) SAW Welding
 - iii) FCAW Welding (By changing electrode diameter & carriage speed)
3. To conduct under water welding (to study bead shape & microstructure)

Note : Students will have to perform at least 8 experiments out of the above list.

**Crash Course
ME-534**

**P
2**

Sessional marks: 25
Theory marks: 25
Durations of exam: 3 hrs

I.C. ENGINES COMBUSTION AND POLLUTION
ME- 506

L T
3 0

Sessional marks: 50
Theory marks : 100
Duration of exams : 3 hrs.

UNIT-I

Fuel air Cycles analysis, Thermodynamics of combustion, Chemical equilibrium, Dissociation, Combustion Charts and gas tables for air fuel mixtures and the products of Combustion. Types of Hydrocarbons in Petroleum fuels, Gasoline grades, required properties of SI and CI engine fuels. Rating of fuels.

UNIT-II

Definition of combustion, combustion modes and flame types, review of property relation, Law of thermodynamics, reactant and product mixtures adiabatic flame temperature, chemical equilibrium and product of combustion. Laminar premixed flame, definition principle characteristics, factors, influencing flame velocity and thickness, flammability limits and quenching of laminar flow, ignition, turbulent flames : turbulent flame propagation, flame stabilization

UNIT-III

Burning of carbon, coal combustion, effect of pollutant emissions from premixed combustion and from non-premixed combustion. Detonation, principle, characteristics one-dimensional, detonation velocity, structure of detonation waves.

UNIT-IV

Pollution : Exhaust gases and analysis, orset apparatus , infrared analyzer, determination of air fuel ratios, air pollution and engines.

Text Books:

1. I.C engine Vol. 1 & 2 by Taylor
2. Thermodynamics and Gas Dynamics of IC engines, Vol. 1 & 2 by Horlock and Winter bone.

Reference Books:

1. I.C engine Vol 1 & 2 by Benson and Whitehouse.
2. Thermodynamics analysis of combustion engines, by Campbell

TOTAL QUALITY MANAGEMENT (TQM)
ME 507

L T
3 0

Sessional marks: 50
Theory marks : 100
Duration of exams : 3 hrs.

Unit-I

Quality Concepts

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type.

Control on Purchased Product

Procurement of various products, evaluation of supplies, capacity verification,
Development of sources, procurement procedure.

Manufacturing Quality

Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

Unit-II

Quality Management

Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

Human Factor in Quality

Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods.

Unit-III

Control Charts

Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

Unit-IV

Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Unit-V

ISO-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details

References:

1. Lt. Gen. H.LaI, "Total Quality management", Wiley Eastern Limited, 1990. .
2. Greg Bounds. "Beyond Total Quality Management". McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill

MODELLING & SIMULATION

ME-508

L T
3 0

Sessional marks: 50
Theory marks : 100
Duration of exams : 3 hrs.

UNIT-I

Concept of system, system environment, elements of system, system modeling, types of models, Monte Carlo method. System simulation- a management laboratory, advantages & limitations of system simulation, continuous & discrete systems.

UNIT-II

Simulation of Continuous systems: Characteristics of a continuous system, comparison of numerical integration with continuous simulation system. Simulation of an integration formation.

Simulation of discrete systems: Time flow mechanisms, discrete and continuous probability density functions, Generation of random numbers, testing for randomness and for auto correlation, generation of random variates for discrete distribution.

UNIT-III

Simulation of Queuing system: Concept of queuing theory, characteristics of queues, stationary & time dependent queues, Queue discipline, time series analysis, measure of system performance, kendal's notation, simulation of single sever queues multi-server queues.

Simulation of inventory systems: Rudiments of inventory theory, MRP, in process inventory, necessity of simulation I inventory problems, forecasting & regression analysis, forecasting through simulation.

UNIT-IV

Design of simulation experiments: Length of run, elimination of initial bias, variance reduction techniques, stratified sampling, antipathetic sampling, common random numbers.

Simulation languages: Continuous & discrete simulation languages, block structure, continuous languages, special purpose simulation languages, SIMSCRIPT, GPSS, SIMULA, importance & limitation of special purpose languages.

Text Books:

1. System simulation by Gordon
2. System simulation by Hira

ADVANCE PRODUCTION LAB
ME-535

L T
3 0

Sessional marks: 25

Theory marks : 25

Duration of exams : 3 hrs.

LIST OF EXPERIMENTS

1. To study about Abrasive Jet Machining.
2. To study the Process of Electrical Discharge M/C
3. To study the Process of Electrochemical Grinding
4. To study the process of Ultrasonic Machining
5. To study the Process of Electrochemical Machining
6. To study about the Jet Machining

MECHATRONICS LAB
ME-536

L T
3 0

Sessional marks: 25
Theory marks : 25
Duration of exams : 3 hrs.

LIST OF EXPERIMENTS

1. Study of sensor & Transducers.
2. Study of operational Amplifier
3. Study of Pneumatic & Hydraulic System
4. Study of Mechanical System
5. Study of Computer & Microprocessor equipments
6. Study of Programmable controller

ADVANCED KINEMATICS & DYNAMICS OF MACHINES

ME 601

L T P
3 0 0

Sessional: 50 Marks
Exams : 100 Marks
Duration of exam: 3 hrs.

- UNIT-I Kinematics of plan and complex mechanism:
Introduction. Advanced kinematics of plane motion. Inflection points and the inflection circle. Luler-savary equation. Geometric construction. Polode curvature. Cubic of stationary curvature.
- UNIT-II Synthesis of plane mechanism:

Introduction. Number synthesis. Dimensional synthesis. Motion generation. Path generation. Function generation. Complex number modeling graphical. Analytical and combined methods of synthesis.
- UNIT-III Kinematics synthesis of advance topics:

Introduction. Synthesis of multi loop linkage. Burmester theory. Synthesis of general linkage and cam mechanism multiple reparted position synthesis. Computer programme for synthesis.
- UNIT-IV Dynamics of mechanism:

Introduction. General principle of dynamics. Kineto-statics using matrix method. Time response. Modification of time response of mechanism.
- UNIT-V Balancing of linkage:

Introduction. Force and moment balancing of linkage. Optimization of shaking moments, shaking moment balancing. Effect of moment balance on input torque computer programme for force and moment balancing. Balancing of flexible rotors. Field balancing.
- UNIT-VI Machine turbines:

Introduction. Single and multiple degree of freedom systems. Vibration of beam and shafts. Practical applications.
- UNIT-VII Kinematics analysis of industrial robots:
Transformation. Spatial transformation. Position analysis. Acceleration anlysis. Point kinematics in three dimensional space.

Text Books:

1. Advanced mechanism design by Sandoor and Brdman
2. Theory of machines and mechanism by A. Ghosh & A. Malik.
3. Theory machines by J. C. Shiegley

ADVANCED METEROLOGY & CALIBRATION ME-602

L T P
3 0 0

Sessional: 50 Marks
Exam : 100 Marks
Duration of exam: 3 hrs.

UNIT – I

Fundamental deviation and its calculations, effect of tolerance on the fits, effects of electroplating on the fits and its solution, shaft basis and hole basis system and its applications, Go, No-Go gauges design, tolerance position and tolerance for bolt and nut. Geometrical Tolerances.

Surface errors i.e. form, macro and micro errors, reasons for these errors.

Surface texture parameters, amplitude, spacing and hybrid, bearing ratio / ABBOTT-Fire stone curve, Average Slope (α)

UNIT – II

Measuring instrument for flatness & surface finishes, instrument for geometrical tolerances, profile projector, co-ordinate measuring machine, laser micrometer, various grades of slip gauges and pin gauges, auto collimeters, various types of micrometer

UNIT – III

Introduction to calibration, calibration of mechanical measuring instruments, micrometers depth-micrometer, vernier caliper, toolmaker microscope, pin gauge, surface plate, dial gauges, optical flats, slip gauges.

UNIT – IV

Calculation of uncertainty, both A type & B type, for micrometers, vernier Calipers and co-ordinate measuring Machine

Text Books:

1. Engineering Metrology And Instrumentation by R.K.Rajput
2. ISI – Standard 919 and ISI-Standard 4218.
3. Geometrical Tolerances Is: 800 (Part-I) – 1985 ISO 1101 – 1983
4. Engineering Tolerances by H.G. Conwat

Metrology lab
ME – 613

L T P
0 0 12

Sessional: 25 Marks
Exam : 25 Marks
Duration of exam: 3 hrs

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
 - a) Lathe tool Dynamometer
 - b) Drill tool Dynamometer.
5. Measurement of Screw thread Parameters using Two wire or Three-wire method.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

PROJECT ME-611

L	T	P
0	0	12

Sessional: 100 Marks

Exam : 100 Marks

Duration of exam: 3 hrs

Project should be a detailed study followed by verification of a research paper published in an international journal of repute (from last 5years) or Simulation/Modeling of an existing problem or a design and investigation or a demonstrable experimental work of any contemporary problem.

Conduct: The student should present the synopsis within fortnight followed by a progressive presentation within one month after the synopsis. There will be a final presentation/demonstration and viva-voce by external examiner.

SEMINAR
ME-612

L T P
0 0 12

Sessional: 100 Marks
Exam : 100 Marks
Duration of exam: 3 hrs

Programme Elective-I

METHOD ENGINEERING AND ERGONOMICS

ME-521

L T
3 0

Sessional Marks 50
Theory Marks 100
Duration of Exam : 3 hrs

UNIT-I

Introduction to industrial engineering and productivity, measurement of productivity, Introduction to work study, methods study principles and motion economy, Filming techniques and micro-motion analysis, Introduction to work measurement. Time study, performance allowances, work sampling,

UNIT-II

Introduction of Ergonomics, system approach to ergonomic model, .Area of study covered under ergonomics ,man/machine systems, characteristics of man machine system, limitation of man & machine with respect to each other. Design approach: Work design consideration, General principles for carrying out the physical activities, Design of work place, machine at work place, seat for workplace.

UNIT-III

Controls: Criteria for control design, Hand controls and foot controls, Relationship between controls and display instruments, Controls for high precision work (Push buttons, Toggle switches, knobs etc.), Layout of panels and machine
Displays:- Types of displays, Design recommendation for quantitative displays.

UNIT-IV

Climates:- Heat Humidity- Fundamentals of human thermal regulation, measuring the thermal environment, work in hot climate, work in cold climate protection against climatic extremes, effect of climate on performance.

Noise:- Terminology, physiological effects of noise, annoyance of noise, speed interference, hearing loss, temporary and permanent threshold shift, effect of noise on performance reduction of noise, personal noise protection.

Text Books:

1. Method Engineering study – Krick, S.V.
2. Work study and Ergonics – Suresh Dalela, Saurabh.

Reference Books:

1. Introduction of Ergonomics-Bridger-Tata McGraw Hill 1995
2. Work Study - Khanna– Dhanpat Rai & Sons-1995

JIGS AND FIXTURES

ME-522

L T
3 0

Sessional Marks 50
Theory Marks 100
Duration of Exam : 3 hrs

UNIT -I

Degree of freedom & Restrain, Location methods, Design of guide pins & dowel pins, Location of irregular geometrical product, Calculation of forces & Torque exerted by machining methods.

UNIT -II

Purpose types and functions of jigs and fixtures, Tool design objectives - Production devices-Inspection devices-Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis.

UNIT -III

Jigs, Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, Turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of jigs for given components.

UNIT -IV

Fixtures for machining and inspection, General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and Shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component.

Text Books:

1. Edward G Hoffman, “Jigs & Fixture Design”, Thomson – Delmar Learning, 2004
2. Donaldson. C, “Tool Design”, Tata McGraw-Hill, 1986

Reference Books:

1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society, 1978
2. Joshi, P.H., “Jigs & Fixtures”, Second Edition, Tata McGraw-Hill Publishing Company Limited, 2004
3. Hiram E Grant, “Jigs and Fixture”, Tata McGraw-Hill, 2003
3. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983
4. PSG College of Technology, Coimbatore - Design Data Handbook

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COMPUTATIONAL FLUID DYNAMICS
ME-523

L T
3 0

Sessional Marks 50
Theory Marks 100
Duration of Exam : 3 hrs

UNIT-1 Introduction

History of CFD: Comparison of the three basic approaches in engineering problems solving analytical. Experimental and computational methods. Beam advance in computational techniques.

UNIT-II Problem formulation

The standard procedure for formulating a problem physical and mathematical classification of problems: types of governing differential equations.

UNIT-III Methods of Discretisation:

Basic of finite difference method: Finite element method. Finite volume method and spectral method. Treatment of boundary conditions.

UNIT-IV Numerical solution of Heat conduction problems:

Steady-state problems: (i) One dimensional heat conduction transfer through a pin-fin-din, two dimensional conduction through a plate unsteady state problem: One dimensional transient heat conduction. Explicit and implicit methods. Stability of numerical methods.

UNIT-V Numerical solution of fluid flow problems

Types of fluid flow and their governing equation: Viscous incompressible flows calculation of flow field using the stream function-vorticity method: calculation of boundary layer over a flat plate: Numerical algorithm for solving complete Navier-Stokes equation-MAC method SIMPLE algorithm: Project Problem.

Books recommended:

Numerical heat transfer and fluid flow by Suhas V. Patankar, Taylor and Francis.
Computational fluid dynamics by J. Anderson.

Programme Elective-II

ADVANCED OPERATION RESEARCH ME-524

L T
3 0

Sessional Marks 50
Theory Marks 100
Duration of Exam : 3 hrs

UNIT -I

Linear programming: The theory of simplex solution, alternate optimal solution, unbounded solutions, In feasible solutions, Formulation of LP models for production scheduling, network planning, inventory maintenance and capital budgeting and similar industrial problems. Two phase method, revised simpler method and dual simplex method sensitivity analysis. The dual problem and its role for post optimality analysis. The transportation and assignment models. Traveling sales man model and their industrials applications.

UNIT-II

Dynamics optimization models: Formulation of dynamic optimization models for common industrials problems. Optimization of non-linear objective function by dynamics programming. on-Linear Optimization Models: Non-Linear objective queuing function of unconstrained variables, quadratic programming.

UNIT-III

Queuing Models: Queuing with single and parallel channels with limited and unlimited services. Bulk input, Bulk service, and priority queue discipline.

UNIT-IV

CPM PERT: Introduction to net work logic, Numbering of events (Fulkersen Rule), PERT calculations - Forward path, backward path. Slack, probability, comparison with PERT, Critical path, floats. Project cost, crashing the network, updating (PERT and CPM).

Text Books:

- 1.Principles of OR by Wagner
2. Introduction to OR by Hira & Gupta

TOOL AND DIE DESIGN
ME-525

L T
3 0

Sessional Marks 50
Theory Marks 100
Duration of Exam : 3 hrs

UNIT -I

Tools Materials and their heat treatment, Mechanism and geometry of chip formation, effect of large and small shear angles on chip thickness and length of shear planes study of cutting forces, friction forces, mean shear strength coefficient of for cutting, method of calculating the metal remove rate. Influence of rake angle side cutting edge & nose radius on cutting forces. Relationship between temperature and hardness of cutting tool materials, Tool geometry of single point and Multipoint Cutting Tool

UNIT - II

Press working terminologies and elements of dies and strip lay out, Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block die shoe. Bolster plate-punch plate-punch holder-guide pins and bushes – strippers – knockouts-stops – pilots-Selection of standard die sets strip lay out-strip lay out calculations.

UNIT -III

Design and development of dies, Design and development of progressive and compound dies for Blanking and piercing, operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies

UNIT- IV

Plastic as a tooling material, commonly used plastic for tooling material, application of epoxy plastic tools, Construction methods of plastic tooling, Metal forming operation with Urethane dies. Calculating forces for Urethane pressure pads.

Text Books:

- Tool Design by Cyril Donation, George H. Lecain, V C Goold.
2. Edward G Hoffman, “Jigs & Fixture Design”, Thomson – Delmar Learning, 2004
3. Donaldson.C, “Tool Design”, Tata McGraw-Hill, 1986

Reference Books:

1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society, 1978

2. Joshi, P.H., "Jigs & Fixtures", Second Edition, Tata McGraw-Hill Publishing Company Limited, 2004
3. Hiram E Grant, "Jigs and Fixture", Tata McGraw-Hill, 2003
4. "Fundamentals of Tool Design", CEEE Edition, ASTM, 1983
5. PSG College of Technology, Coimbatore - Design Data Handbook

MACHINE TOOL DESIGN
ME-526

L T
3 0

Sessional Marks 50
Theory Marks 100
Duration of Exam : 3 hrs

UNIT- I

Introduction to Machine Tools and Mechanisms: General principles of machine tool design, working and auxiliary motions, machine tool drives, hydraulic and mechanical transmission and its elements, general requirements of machine tool design, layout of machine tools. Regulation of Speed and Feed Rates: Purpose, stepped regulation of speed-design of speed box, machine tool drives using multiple speed motors, developing the gearing diagram, step-less regulation of speed and feed rates.

UNIT- II

Machine Tool Structure: Functions and requirements, design criteria, materials used and their properties, static and dynamic stiffness, cross-sectional shapes used for machine tool structures and basic design procedure for the design of beds, columns and other structural elements, model techniques used in design, introduction to Finite Element Method (FEM).

UNIT- III

Guideways and Power Screws: Function and types, design considerations & procedure for slideways, design of power screws.

UNIT -IV

Spindles and Spindle Supports: Functions and requirements, materials, effect of machine tool compliance on machining accuracy, design of spindles, bearings design/selection. Control Systems: Functions, requirements and classification, control systems for speeds, feeds & auxiliary motions, manual control systems, automatic control systems, adaptive control systems, criteria and economic selection of machine tools, future trends in development of machine tools.

Text Book:

Machine tool design By N.K.Mehta

Design of Machine Tool By S.K.Basu

General Elective

RAPID PROTOTYPING ME-621

L T
3 0

Sessional Marks 50
Theory Marks 100
Duration of Exam : 3 hrs

UNIT-I

Introduction:

Basic Concepts: Overview of existing technologies of proto typing and tooling, need for speed design to market operations, State of the technology: Conceptual design, development, detail design, prototype, tooling

UNIT-II

Cad Processes:

Data requirements, solid modeling, data representation, part orientation and support, STL format, slicing, post processing.

UNIT-III

Rapid Prototyping Systems: Selective laser sintering: working principles, advantages and limitations, Sterolithography: working principle, applications, advantages and limitations, case studies.

UNIT-IV

Other Systems:

Laminated object modeling: waving principles, applications, advantages and limitations, Fused deposition modeling: direct shell production casting, applications.

Text Books:

1. Paul F. Jacobs, "Rapid Prototyping and Manufacture Fundamentals of Stereolithography", 1995.
2. Soenen, R. and Olling, "Advanced CAD/CAM Systems", Narosa Publishing house, 1995.

Reference Books:

1. Duvvent, W.R. "The Lithographic Handbook", Narosa Publishing house, 1995.
2. Rapid News, University of Warwlok, UK, 1995.

COMPUTER INTEGRATED MANUFACTURING SYSTEMS

ME-622

L T
3 0

Sessional Marks 50
Theory Marks 100
Duration of Exam : 3 hrs

UNIT I

Group Technology and Computer Aided Process Planning: Introduction-part families-parts classification and cooling: group technology machine cells, benefits of group technology. Process planning function CAPP: Computer generated time standards.

UNIT II

Computer Aided Planning and Control: Production planning and control-cost planning and control: inventory management, Material requirements planning (MRP): shop floor control, factory data collection system, automatic identification system, barcode technology, automated data collection system.

UNIT III

Computer Monitoring: Types of production monitoring systems, structure model of manufacturing process, process control & strategies, direct digital control, supervisory computer control, computer in QC, contact inspection methods non, contact inspection method, computer-aided testing, integration of CAQC with CAD/CAM.

UNIT IV

Integrated Manufacturing System: Definition, application, features, types of manufacturing system, machine tools, materials handling system, computer control system, DNC systems manufacturing cell.

Flexible manufacturing systems (FMS): The FMS concept-transfer systems, head changing FMS, variable mission manufacturing system CAD/CAM system, human labour in the manufacturing system, computer integrated manufacturing system benefits. Rapid prototyping. Artificial intelligence and expert system in CIM.

Text Books:

1. Roger, Hannam, “ Computer Integrated Manufacturing – from Concepts to Realization’’, Addition Wesley.

Reference Books:

1. James A. Rehg & Henry W. Kraebble- “ Computer Integrated Manufacturing’’, Pearson Education Asia.
2. Singh, Nanua , “ system Approach to Computer Integrated Manufacturing’’, John Wiley & Sons
3. Grover, M.P., “Automation, Production System and CIM’’, Prentice-Hall of India, 1998.
4. Davind Bedworth, “Computer Integrated Design and Manufacturing’’, TMH, New Delhi, 1998.
5. Yorem Koren, “Computer Integrated Manufacturing Systems’’, McGraw Hill, 1983.
6. Ranky, Paul G.,”Computer Integrated Manufacturing’’, Prentice Hall International 1986.

DESIGN OF EXPERIMENTS & RESEARCH METHODOLOGY
ME-623

L T
3 0

Sessional Marks 50
Theory Marks 100
Duration of Exam : 3 hrs

UNIT-I

Research Concepts – Concepts, meaning, objectives, motivation, types of research, approaches, research (Descriptive research, Conceptual, Theoretical, and Applied & Experimental). Formulation of Research Task – Literature Review, Importance & Methods, Sources, quantification of Cause Effect Relations, Discussions, Field Study, Critical Analysis of Generated Facts, , selection of Research task.

UNIT - II

Design of experiment – Definition of Experimental Design, Examples, Single factor Experiments, Guidelines for designing experiments. Process Optimization and Designed experiments, Methods for study of response surface, determining optimum combination of factors, Taguchi approach to parameter design.

UNIT - III

Analysis of Results – Parametric and Non-parametric, descriptive and Inferential data, types of data,. One way and 2 way classified data, methods of data collection, processing analysis, error analysis, different methods, analysis of variance, significance of variance, analysis of covariance

UNIT – IV

Report Writing – Types of reports, layout of research report, interpretation of results, style manual, layout and format, style of writing, typing, references, tables, figures, conclusion, appendices.

Note: The examiner will set nine questions, taking first question from entire syllabus, and two questions from each unit. Students are required to attempt five questions in all selecting at least one question from each unit and first question is compulsory. All questions will carry equal marks.

Reference Books:

1. Wilkinson K. L, Bandera P. L, Formulation of Hypothesis, Himalaya Publication.
2. Schank Fr., Theories of Engineering Experiments, Tata Mc Graw Hill Publication.
3. Douglas Montgomery, Design of Experiments, Statistical Consulting Services, 1990..
4. John W. Besr and James V. Kahn, Research in Education, PHI Publication.
5. C. R. Kothari, Research Methodology, New Age Publishers, 2005.