J. S. University, Shikohabad

M. Tech.
(Mech. Engineering)
I- SEMESTER & II- SEMESTER

Scheme
&
Syllabus

[Effective from the session 2015-16]

I- SEMESTER

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
1	MTME-11	Numerical Methods and Computer Programming	3	1	-	-	50	100	150	3
2	MTME-12	Simulation, Modelling and Analysis	3	1	-	-	50	100	150	3
3	MTME-13	Applied Operations Research	3	1	-	-	50	100	150	3
4	MTME-14	Product Design and Development	3	1	-	-	50	100	150	3
								Grand Total	600	

II- SEMESTER

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
1	MTME-21	Optimization for Engineering Design	3	1	-	-	50	100	150	3
2	MTME-22	Advanced Mechanics of Solids	3	1	-	-	50	100	150	3
3	MTME-23	Production Technology	3	1	-	-	50	100	150	3
4	MTME-24	Total Quality Management	3	1	-	-	50	100	150	3
								Grand Total	600	

STUDY AND EVALUATION SCHEME FOR

SEMESTER – Third

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	MTME-31	Advance Thermal Engineering	3	1	-	-	50	100	150	3
2	MTME-32	Reliability, Maitenance Management& Safety	3	1	-	-	50	100	150	3
3	MTME-33	Project	-	-	8	-	50	-	50	3
4	MTME-34	Seminar/Minor Project	-	-	2	-	100	-	100	3
							Grand Total		450	

SEMESTER – FORTH   **THEORY SUBJECT**

1	MTME-41	DISSERTATION a) Continuous Evaluation b) Project Report c) Viva Voice	-	-	18	-	150	200	350	

	Grand Total	350

[MTME-11] NUMERICAL METHODS AND COMPUTER PROGRAMMING

Solution of Algebraic and Transcendental Equation: Newton-Raphson method including method of complex roots,

Graeffe's root square method (Computer based algorithm and programme for these methods)

Interpolation and Approximation: Lagrange's and Newton-divided difference formula, Newton interpolation formula forfinite differences, Gauss's forward and backward interpolation formulae, Bessel's and Laplace-Everett's formulae, Cubicspline, least squares approximation using Chebyshev polynomial.

Solution of Linear Simultaneous Equations: Cholesky's (Crout's) method, Gauss-Seidel iteration and relaxation

methods, Solution of Eigenvalue problems; Smallest, largest and intermediate Eigen values (Computer based lgorithmand programme for these methods)

Numerical Differentiation and Integration: Numerical differentiation using difference operators, Simpson's 1/3 and 3/8rules, Boole's rule, Weddle's rule.

Solution of Differential Equations: Modified Euler's method, Runge-Kutta method of 2nd, 3rd and 4th orders, Predictor-Corrector method, Stability of Ordinary differential equation, Solution of Laplace's and Poisson's equations byLiebmann's method, Relaxation method.

Books:

1. Numerical Method for Scientific and Engineering Computation M.K. Jain, S.R.K. Iyenger and R.K. Jain Wiley Eastern Ltd.

2. Numerical Methods for Engineers S.K. Gupta Wiley Eastern Ltd.

3. Numerical Methods B.S. Grewal Khanna Publications

[MTME-12] SIMULATION, MODELLING AND ANALYSIS

Introduction: A review of basic probability and statistics, random variables and their properties, Estimation of means variances and correlation.

Physical Modelling: Concept of System and environment, Continuous and discrete systems, Linear and non-linear systems, Stochastic activities, Static and Dynamic models, Principles of modeling, Basic Simulation modeling, Role of simulation in model evaluation and studies, advantages of simulation

System Simulation: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques, Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages.

System Dynamics: Growth and Decay models, Logistic curves, System dynamics diagrams.

Probability Concepts in Simulation: Stochastic variables, discrete and continuous probability functions, Random numbers, Generation of Random numbers, Variance reduction techniques, Determination of length of simulation runs.

Simulation of Mechanical Systems: Building of Simulation models, Simulation of translational and rotational mechanicalsystems, Simulation of hydraulic systems.

Simulation of Manufacturing Systems: Simulation of waiting line systems, Job shop with material handling and Flexiblemanufacturing systems, Simulation software for manufacturing, Case studies.

Books:

1. System Simulation Geoffrey Gordon Prentice Hall

2. System Simulation: The Art and Science Robert E. Shannon Prentice Hall

3. System Modelling and Control J. Schwarzenbach and K.F. Gill Edward Arnold

4. Modelling and Analysis of Dynamic Systems Charles M Close and Dean K. Frederick Houghton Mifflin

5. Simulation of manufacturing Allan Carrie John Wiley & Sons

[MTME-13] APPLIED OPERATIONS RESEARCH

Introduction: Definition and scope of OR, Techniques and tools, model formulation, general methods for solution,

Classification of Optimization problems, Optimization techniques

Linear Optimization Models: Complex and revised Simplex algorithms, Degeneracy and duality, Post optimum and

Sensitivity analysis, Assignment, transportation and transshipment models, Traveling salesman problem, Integer and

parametric programming.

Game Problems: Minimax criterion and optimal strategy, two persons zero sum game, Games by Simplex dominancerules.

Waiting Line Problems: Classification of queuing problems, M/M/1 & M/M/1/N queuing systems, Steady state analysisof M/M/m queues, Discrete and continuous time Markov models, Chapman-Kolmogorov equation, Birth & deathprocesses in manufacturing, Open and Closed queuing networks.

Inventory Management: ABC analysis, deterministic and Probabilistic models.

Dynamic Programming: Characteristics of dynamic programming problems, Bellman's principle of optimality, Problemswith finite number of stages.

Stochastic Programming: Basic concepts of Probability theory, Stochastic linear programming.

Books:

1. Elements of Queuing Theory SaatyPitam

2. Nonlinear and Dynamic Programming Hadley Addison Wesley

3. Fundamentals of Operations Research Ackoff&Sasieni Wiley eastern

4. Principles of OR with Applications to Managerial Decisions Wagner Prentice Hall

[MTME-14]   PRODUCT DESIGN AND DEVELOPMENT

UNIT-1

Introduction, Sources of new ideas, Development processes, Product planning, Identification for Customer needs and

technology potentials, Innovation and intellectual property rights, Product and process Patents, Patents and patenting

processes.

UNIT-2

Product specifications, Tolerance specifications, Taguchi loss factor concepts, Quality function deployment, Functionalspecifications of products, Form and function, Development of alternatives.

UNIT-3

Design for manufacture, Design for Assembly and design for economy, Prototyping and analytical prototyping, Stage-gateprocess of product development.

UNIT-4

Holistic product development approaches-Form product concept to decommissioning, Environment requirements, Lifecycle design, Product data management and Product life cycle management systems, Dependency and concurrent engineering in development of products.

UNIT-5

Internet based approach to product development involving users. Democratizationof innovation, Connecting products to services, Experience innovation, Robust design, Patents and Intellectual properties,product Developments.

Books:

1. Production Management K K Ahuja CBS Publishers

2. Production Design and Manufacturing A.K. Chitale& A.K. Gupta Prentice Hall of India

3. Management Development Alan Mumford Jaico Publishing House

[MTME-21] OPTIMIZATION FOR ENGINEERING DESIGN

UNIT-1

Introduction: Historical Developments, Engineering applications of Optimization

Classical Optimization Techniques: Introduction, Review of single and multivariable optimization methods with andwithout constraints, Non-linear one-dimensional minimization problems, Examples.

UNIT-2

Constrained Optimization Techniques: Introduction, Direct methods - Cutting plane method and Method of Feasibledirections, Indirect methods - Convex programming problems, Exterior penalty function method, Examples and problems.

UNIT-3

Unconstrained Optimization Techniques: Introduction, Direct search method - Random, Univariate and Pattern searchmethods, Rosenbrock's method of rotating co-ordinates, Descent methods - Steepest Decent methods-Quasi-Newton's andVariable metric method, Examples.

UNIT-4

Geometric Programming: Introduction, Unconstrained minimization problems, solution of unconstrained problem fromarithmetic-geometric inequality point of view, Constrained minimization problems, Generalized polynomial optimization,Applications of geometric problems, Introduction to stochastic optimization.

UNIT-5

Novel methods for Optimization: Introduction to simulated annealing, selection of simulated annealing parameters,

simulated annealing algorithm; Genetic Algorithm (GA), Design of GA, Key concepts of GA, Neural Networks, A framework for Neural Network models, Construction of Neural Network algorithm, Examples of simulated algorithm, geneticannealing and Neural Network method.

Books:

1. Engineering Optimization S. S. Rao New Age International

2. Applied Optimal Design E. J. Haug and J.S. Arora Wiley, New York

3. Optimization for Engineering Design Kalyanmoy Deb Prentice Hall of India

[MTME-22] ADVANCED MECHANICS OF SOLIDS

Analysis of stress and strain, Constitutive relationships, failure theories, Torsion of non-circular sections, Plane stress andplain strain problems, Review of fatigue analysis, Introduction to fracture mechanics, Inelastic behaviour, Viscoelasticity,Structure and behaviour of polymers, Behaviour of unidirectional composites and orthotropic lamina, Failure theories forfibre composites, development of various structures in composites, Computer based analysis and solutions to problems inmechanics of solids.

Books:

1. Theory of Elasticity (Foundations of Engineering Mechanics) A I Lurie -

2. Fracture Mechanics: Fundamentals and Applications T.L. Anderson CRC Press

3. Mechanical Behaviour of Materials: Engineering Methods for Deformation, fracture and Fatigue Dowling, Norman E Prentice Hall

[MTME-23] PRODUCTION TECHNOLOGY

UNIT-1

Welding Technology: Welding comparison with other fabrication processes, Classification, Fusion and pressure welding,Weldability of metals, Metallurgy of welding, Weld design, Stress distribution and temperature fields in the welds, Recentdevelopments in welding viz. Diffusion, Friction, Electron beam and Induction welding, Cladding, Metallizing, Surfacingand Fabrication, Welding defects and inspection of welds, Thermal cutting of metals and its use in fabrication of processmachines, Cutting of cast iron, stainless steel and non-ferrous metals.

UNIT-2 & 3

Metal Forming: Classification of forming process, Stress, strain and strain rules, laws, Yield criterion and flow rules,

Friction and lubrication in metal forming processes, Indirect compression processes e.g., Drawing and Extrusion processes,Direct compression processes e.g., forming and rolling, Theory of deep drawing, Load bounding techniques

and upperbound estimates of field theory, Bending and forming, High-energy rate forming techniques and their applications, Recentadvances in metal forming.

UNIT-4 & 5

Metal Cutting: Tool geometry and signature, Theory of orthogonal and oblique metal cutting, Tool wear and lubrication,Theoretical evaluation of temperature fields at shear zone and tool-chip interface, Dynamics of metal cutting and machinetool stability, A critical review of theories of dynamic cutting machining at super high speeds, recent advances in cuttingtool and science of metal cutting.

Books:

1. Fundamentals of Metal Machining G. Boothroyd -

2. Metal Forming Analysis Avitzur -

3. Metal Cutting Principle M.C. Shaw

[MTME-24] TOTAL QUALITY MANAGEMENT

UNIT-1
Introduction and Components of TQM: Concept and Philosophy of TQM, Value and Quality assurance, Total QualityControl, Quality policy, Team-work and participation, Quality cost measurement, Quality Circle, Customer/Supplierintegration, Education and training.
UNIT-2
Tools and Techniques of TQM: Statistical method in quality control, Process control chart, Acceptance sampling plan,Statistical Productivity control (SPC)
UNIT-3
Reliability: Failure analysis, System reliability and redundomy
UNIT-4
TQM implementation: Steps in promoting and implementing TQM in manufacturing industries, Industrial Case studies.
UNIT-5

ISO 9000 Quality Systems: Concepts, designation Standards, Quality system documentation, Quality manual, Qualityprocedures and work inspection.

Books:

1. Total Quality Control F. Ammandev Tata McGraw Hill

2. Total Quality Management Besterfield, et. al. Prentice Hall of India

3. Total Quality Management: Text and Cases B. Janakiraman& RKGopalPrentice Hall of India.

[MTME-31]ADVANCED THERMAL ENGINEERING

Basic Definitions & Concepts, Equation of state, Calculation of thermodynamic properties, Generalized compressibility charts, Second law analysis, Availability, irreversibility, Maxwell equations, Joule-Thomson coefficient, Thermodynamics of reactive mixtures, Stoichiometry. Generalized conduction equation, Steady and unsteady heat conduction in a slab of finite thickness; Effect of heat generation; Non-zero initial condition, Constant flux and convective boundary conditions, Heat conduction in an inhomogeneous medium; Examples of composite media; Radiation heat transfer, Surface properties, Configuration factor,Radiative heat exchange between gray surfaces.Navier-Stokes equation, Stream function, Velocity potential, Vorticity and circulation potential flow theory, Boundary layer theory.

[MTME-32]RELIABILITY, MAINTENANCE MANAGEMENT & SAFETY

Reliability Engineering: System reliability - series, parallel and mixed configuration, Block diagram, r-out-of-n structure,Solving problems using mathematical models. Reliability improvement and allocation-Difficulty in achieving reliability,Method of improving reliability during design, different techniques available to improve reliability, Optimization,Reliability – Cost trade off, Prediction and analysis, Problems.
Maintainability, Availability & Failure Analysis: Maintainability & Availability – Introduction, formulae, Techniques available to improve maintainability & availability, trade off among reliability, maintainability & availability, simple problems, Defect generation – Types of failures, defects reporting and recording, Defect analysis, Failure analysis,Equipment down time analysis, Breakdown analysis, TA, FMEA, FMECA.
Maintenance Planning and Replacement: Maintenance planning – Overhaul and repair; Meaning and difference, Optimal overhaul/Repair/Replace maintenance policy for equipment subject to breakdown, Replacement decisions – Optimal interval between preventive replacements of equipment subject to breakdown, group replacement.
Maintenance Systems: Fixed time maintenance, Condition based maintenance, Operate to failure, Opportunity maintenance, design out maintenance, Total productive maintenance, Inspection decision – Optimal inspection frequency,non-destructive inspection, PERT & CPM in maintenance, Concept of terrotechnology.
Condition Monitoring: Techniques-visual monitoring, temperature monitoring, vibration monitoring, lubricant monitoring, Crack monitoring, Thickness monitoring, Noise and sound monitoring, Condition monitoring of hydraulic system, Machine diagnostics - Objectives, Monitoring strategies, Examples of monitoring and diagnosis, Control structure for machine diagnosis.

Safety Aspects: Importance of safety, Factors affecting safety, Safety aspects of site and plant, Hazards of commercial
chemical reaction and operation, Instruments for safe operation, Safety education and training, Personnel safety,
Disaster planning and measuring safety effectiveness, Future trends in industrial safety.

Books:

1. Concepts in Reliability Engineering L.S. Srinath Affiliated East West Press
2. Maintainability and Reliability Handbook Editors: Ireson W.A. and C.F.
Coombs
McGraw Hill Inc.
3. Failure Diagnosis and Performance Monitoring L.F. Pau Marcel Dekker
4. Industrial Maintenance Management S.K. Srivastava S. Chand & Co Ltd.
5. Management of Industrial Maintenance Kelly and M.J. Harris Butterworth and Co.
6. Maintenance, Replacement and Reliability A.K.S. Jardine Pitman Publishing
7. Engineering Maintainability: How to Design for
Reliability and Easy Maintenance
B.S. Dhillon Prentice Hall of India