J. S. University, Shikohabad

M. Tech

(Mechanical Engineering)

Scheme

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Syllabus

[Effective from the session 2015-16]

J.S. University Sheikhabad

1.1.1: Curricula developed and implemented have relevance to the local, national, regional and global developmental needs which is reflected in Programmer outcomes (POs), Programmer Specific Outcomes (PSOs) and Course Outcomes (COs) of the Programmer' offered by the University.

PROGRAMME OUTCOMES (PO'S)

Post Graduates (M. Tech) in Mechanical engineering will be able to:

Program outcome:

PO.1 An ability to independently carry out research /investigation and development work to solve practical problems related to Production and Industrial Engineering

PO.2 An ability to write and present a substantial technical report/document.

PO.3 The ability to apply knowledge, techniques, skills and modern tools of manufacturing technology listed below to the solution of manufacturing and industrial engineering problems: 1. Materials 2. Manufacturing Processes 3. Quality 4. Automation 5. Industrial Engineering.

PO.4 The ability to apply creativity in designing manufacturing systems, components and processes.

PO. 5 The ability to Design and Conduct Experiments, Interpret and Analyzes Data and Report Results.

PO. 6 The ability to Design and Evaluate a Manufacturing System/Process which is Environment Friendly with Appropriate consideration for Public Health and Safety.

PO.7 Understanding of their Professional Ethical Responsibilities.

PO. 8 The ability to Function Effectively Individually and also as a Team Member in Multidisciplinary activities.

1. The ability to Employ Effective Project Management Skills to Develop a Project Plan
2. The ability to understand the value of Life-long Learning in Continuing Professional development.

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

After successful completion of Mechanical Engineering program, the Post graduates will be able to:

PSO. 1 Research and development new ideas on product design and development with the help of modern numerical methods, while ensuring best manufacturing practices

PSO. 2 Apply engineering knowledge and design & analysis tools to solve problems in the domains of structural, thermal and fluid mechanics

PSO. 3 Develop product, Manufacturing processes and products in an efficient, safe and cost effective manner.

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	

III- SEMESTER

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, Maintenance Management& Safety	3	1	-	-	50	100	150	3
3	MTME-33	Seminar	-	-	2	-	100	-	100	3
4	MTME-34	Project	-	-	8	-	50	-	50	3
								Grand Total	450	

V- SEMESTER

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

Objective: In This course exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques. Use the concepts of interpolation, eigen value problem techniques for mathematical problems arising in various fields. Solve initial value and boundary value problems which have great significance in engineering practice using ordinary and partial differential equations. Demonstrate elementary programming language, implementation of algorithms and computer programs to solve mathematical problems.

Subject Code:MTME-11	**NUMERICAL METHODS AND COMPUTER PROGRAMMING**	**L T P : 3 1 0**	**Credits: 3**

The students will be able to	
CO1	Apply and understand to newton –Raphson for nonlinear equations with different problems.
CO2	Understand the mathematical concepts of Laplace and other theorem with practical applications.
CO3	Choose appropriate numerical method for treatment of the given problem with computer based lgorithm and programme.
CO4	Apply and understand the concepts of Numerical differential and integration equations with different rules.
CO5	Understand the Runge- Kutta and others methods.

SUYLLABUS

UNIT-I

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)

UNIT-II

Interpolation and Approximation:

Lagrange's and Newton-divided difference formula, Newton interpolation formula for finite differences, Gauss's forward and backward interpolation formulae, Bessel's and Laplace Everett's formulae, Cubic spline, least squares approximation using Chebyshev polynomial.

UNIT-III

Solution of Linear Simultaneous Equations:

Cholesky's (Crout's) method, Gauss-Seidel iteration and relaxation methods, Solution of Eigen value problems; Smallest, largest and intermediate Eigen values (Computer based lgorithm and programme for these methods)

UNIT-IV

Numerical Differentiation and Integration:

Numerical differentiation using difference operators, Simpson's1/3and3/8rules,Boole'srule,Weddle'srule.

UNIT-V

Solution of Differential Equations:

Modified Euler's method, Runge-Kuttamethodof2nd,3rdand4thorders, Predictor-Corrector method, Stability of Ordinary differential equation, Solution of Laplace's and Poisson's equations by Liebmann's method, Relaxation method.

Reference/Hand 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

Objective: The objective of the course is to teach methods and techniques for achieving an effective transformation from requirements and business drivers to technology and product design. The ability to create simulation models of various types. Provide basic knowledge of simulation system principles. Find conclusions from analysis of simulation results.

Subject Code: MTME-12	**SIMULATION MODELLING AND ANALYSIS**	**L T P : 3 1 0**	**Credits: 3**

The students will be able to	
CO1	Understand mathematical concepts of numerical methods like random variables, correlations.
CO2	Understand linear and nonlinear system and also understand role of simulation in models.
CO3	Familiar with different simulation techniques likes Monte Carlo, numerical computation techniques.
CO4	Identify and apply the simulation model in mechanical system and other mechanical problems.
CO5	Understand role of simulation in manufacturing system

SYLLABUS

UNIT-I

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

UNIT-II

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, Simulations of software packages.

UNIT-III

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.

UNIT-IV

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

UNIT-V

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

Reference/Hand 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. ModellingandAnalysisofDynamicSystemsCharlesMCloseandDeanK.FrederickHoughtonMifflin
5. Simulation of manufacturing Allan Carrie John Wiley &Sons

[MTME-13] APPLIED OPERATION RESEARCH

Subject Code: MTME-13	**APPLIED OPERATION RESEARCH**	**L T P : 3 1 0**	**Credits: 3**

The students will be able to	
CO1	This course help to understand to identify the problems and how to resolve optimized.
CO2	Solve the complex problems with the linear optimization models .
CO3	Understand and identify queuing problems and solve theses discrete and continuous time Markov models.
CO4	Understand ABC analysis

UNIT-I

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

UNIT-II

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.

UNIT-III

Game Problems: Mini-max criterion and optimal strategy, two persons zero sum game, Games by Simplex dominan cerules.

Inventory Management: A, d BC analysis deterministic and Probabilistic models.

UNIT-IV

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

UNIT-V

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

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

Reference/Hand Books

1. Elements of Queuing Theory Saaty Pitam
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

Objective: Design and development of innovative products is the key for manufacturing companies to achieve the long-term success and survive in intensively competitive global market.

Subject Code: MTME-14	**PRODUCT DESIGN AND DEVELOPMENT**	**L T P : 3 1 0**	**Credits: 3**

The students will be able to	
CO1	Development of new product, to understand all the aspects which are basic need to develop a product.
CO2	Understand and apply Taguchi concepts for new product
CO3	To consider all factor which are responsible for develop new product
CO4	To understand the major role product life cycle and life cycle management system.

SYLLABUS

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, Functional specifications 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-gate process of product development.

UNIT-4

Holistic product development approaches-Form product concept to decommissioning, Environment requirements, Life cycle 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 .Democratization of innovation, Connecting products to services, Experience innovation, Robust design, Patents and Intellectual properties, product Developments.

Reference/Hand Books

1. Production Management KK 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 OF ENGINEERING DESIGN

Objective: The objective of optimization for engineering design to introduce the fundamental concepts of optimization techniques and to make the learners aware of the importance of optimizations in real scenarios to provide the concepts of various classical and modern methods for constrained and unconstrained problems in both single and multivariable.

Subject Code: MTME-21	OPTIMIZATION OF ENGINEERING DESIGN	L T P : 3 1 0	Credits: 3

The students will be able to	
CO1	Introduction and overview of optimization problems including the notion of convergence and convexity
CO2	Basics of univariate unconstrained minimization
CO3	Fundamentals of multivariate optimization including equation solving and least square problems.
CO4	Discussion of professional (applied) methods for multivariate optimization
CO5	Different family of methods for solving a constrained optimization Problem.

SYLLABUS

UNIT-1

Introduction: Historical Developments, Engineering applications of Optimization

Classical Optimization Techniques: Introduction, Review of single and multi variable optimization methods with and without constraints, Non-linear one-dimensional minimization problems, Examples.

UNIT-2

Constrained Optimization Techniques: Introduction, Direct methods-Cutting plane method and Method of Feasible directions, indirect methods-Convex programming problems, Exteriorpenalty function method, Examples and problems.

UNIT-3

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

UNIT-4

Geometric Programming: Introduction, Unconstrained minimization problems, solution of unconstrained problem from arithmetic-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 frame work for Neural Network models, Construction of Neural Network algorithm, Examples of simulated algorithm, genetic annealing and Neural Network method.

Reference/Hand 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

Objective: The objective of the course is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials is also of interest.

Subject Code: MTME-22	**ADVANCED MECHANICS OF SOLIDS**	**L T P : 3 1 0**	**Credits: 3**
The students will be able to			
CO1	Understand the stress –strain relationship and their practical problem analysis		
CO2	Understand the advanced practical problems related to the theory of elasticity, concepts of stress and strain, strain energy, and failure criteria		
CO3	To be able and understand visco-elastic theory and their problems.		
CO4	Solve the problems with the help of software likes as Ansys, Abaqus		
CO5	Understand the theory of composite structure and their applications**.**		

SYLLABUS

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

Reference/Hand Books

1. Theory of Elasticity (Foundations of Engineering Mechanics)AI Lurie-
2. FractureMechanics:FundamentalsandApplicationsT.L.AndersonCRCPress
3. Mechanical Behaviour of Materials: Engineering Methods for Deformation, fracture and Fatigue Dowling, Norman E Prentice Hall

[MTME-23] PRODUCTION TECHNOLOGY

Objective: To extend the knowledge of Production as input/output model, metal working and types of stresses finally up to crack formation in high speed machining

Subject Code: MTME-23	PRODUCTION TECHNOLOGY	L T P : 3 1 0	Credits: 3

The students will be able to	
CO1	To understand the metallurgical concepts of welding, classification and defects**.**
CO2	To the understand welding cutting for different metals.
CO3	Understand metal forming with yield point criterion and flow rules.
CO4	Understand the role of compressive force in metal forming process and their role in different forming techniques.
CO5	Basic understand tool geometry and tool signature for metal cutting process.
CO6	Understand metal cutting mechanism.

SYLLABUS

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, Recent developments in welding viz. Diffusion, Friction, Electron beam and Induction welding, Cladding, Metalizing, Surfacing and Fabrication, Welding defects and inspection of welds, Thermal cutting of metals and its use in fabrication of process machines, 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 upper bound estimates of field theory, Bending and forming, High-energy rate forming techniques and their applications, Recent advances 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 machine tool stability, A critical review of theories of dynamic cutting machining at super high speeds, recent advances in cutting tool and science of metal cutting.

Reference/Hand 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

Objective: The purpose of this course provides basic understanding Quality management and management services. The principles of Quality, Quality Assurance, and Total Quality Management will provide an insight into the concepts of Excellence and Best Value and the contribution of quality to strategic management.

Subject Code: MTME-24	**TOTAL QUALITY MANAGEMENT**	**L T P : 3 1 0**	**Credits: 3**
The students will be able to			
CO1	To able and understand Total Quality Management system and component of the TQM tools.		
CO2	Understand TQM techniques, process control charts and SPC.		
CO3	Understand risk factors and system reliability.		
CO4	Apply of TQM implementation in different industries and promote		
CO5	Understand the ISO 9000 quality system.		

SYLLABUS
UNIT-1 **Introduction and Components of TQM:** Concept and Philosophy of TQM, Value and Quality assurance, Total Quality Control, Quality policy, Team-work and participation, Quality cost measurement, Quality Circle, Customer/Supplier integration, Education and training.
UNIT-2 **Tools and Techniques of TQM:** Statistical method inquality 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 **ISO9000 Quality Systems:** Concepts, designation Standards, Quality system documentation, Quality manual, Quality procedures and work inspection.

Reference/Hand Books

1. Total Quality Control F.Ammandev Tata Mc Graw Hill
2. Total Quality Management Besterfield, et. al. Prentice Hall of India
3. Total Quality Management: Text and Cases B. Janakiraman &RK Gopal Prentice Hall of India

[MTME-31]ADVANCEDTHERMALENGINEERING

Subject Code: MTME-31	**ADVANCEDTHERMALENGINEERING**	**L T P : 3 1 0**	**Credits: 3**

The students will be able to	
CO1	Understand basic thermodynamic properties and laws
CO2	Understand the thermodynamic reactions of combustion.
CO3	Understand the study of steady and unsteady concepts heat flow of slab finite thickness.
CO4	Understand heat flow concepts with the different Navier –stokes and stream function.
CO5	Understand the theories of vorticity and potential flow and boundary layer theory.

SYLLABUS

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 as lab 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, Vorticity and circulation potential flow theory, Boundary layer theory.

[MTME-32] RELIABILITY, MAINTENANCE MANAGEMENT&SAFETY

Objective: The aim of this course is to provide fundamental concepts of reliability and maintenance in engineering discipline. It describes scientific know-how to a component, assembly, plant, or process work so it will perform its intended function, without failure, for the required time duration when installed and operated correctly in a specified environment and referred maintenance planning to prevent the failure.

Subject Code: MTME-32	**RELIABILITY,MAINTENANCEMANAGEMENT&SAFETY**	**L T P : 3 1 0**	**Credits: 3**
The students will be able to			
CO1	To be able and understand system reliability, facing different barriers and analysis.		
CO2	To the understand concepts about different failure analysis, break down analysis techniques. And their improvement, maintainability.		
CO3	This unit learn about replacement and different types maintenance with the help of different tool likes PERT & CPM.		
CO4	In this section understand the concepts of different monitoring techniques and diagnosis.		
CO5	In this section learn about importance of the safety aspects of the system and types safety.		

SYLLABUS

UNIT-I

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 tradeoff, Prediction and analysis, Problems.

UNIT-II

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, Break down analysis, TA, FMEA, FMECA.

UNIT-III

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.

UNIT-IV

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.

UNIT-V

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.

Reference/Hand Books

1. Concepts in Reliability Engineering L. S. Srinath Affiliated East West Press
2. Maintainability and Reliability Handbook
3. Failure Diagnosis and Performance Monitoring L. F. Pau Marcel Dekker
4. Industrial Maintenance Management S. K. Srivastava S. Chand &CoLtd.
5. ManagementofIndustrialMaintenanceKellyandM.J.HarrisButterworthandCo.
6. Maintenance, Replacement and Reliability A. K. S. Jardine Pitman Publishing