MECHANICAL ENGINEERING DEPARTMENT
MOTILAL NEHRU NATIONAL INSTITUTE OF TECHNOLOGY
ALLAHABAD-211004
Scheme of Examination
M. Tech. (Production Engineering)

PART TIME

I Semester

S. No.	Subject Code	Subject Name	L	T	P	Credit	Distribution of marks out of 100			
							TA	I Mid Exam	II Mid Exam	End Sem Exam
1.	ME 901	Finite Element Method	4	0	0	4	20	20	20	40
2.	ME 912	Production and Operations Management	4	0	0	4	20	20	20	40
3.	ME 903	Computer Aided Manufacturing	4	0	0	4	20	20	20	40

II Semester

S. No.	Subject Code	Subject Name	L	T	P	Credit	Distribution of marks out of 100			
							TA	I Mid Exam	II Mid Exam	End Sem Exam
1	ME 908	Optimization Techniques	4	0	0	4	20	20	20	40
2	ME 910	Machining Science	4	0	0	4	20	20	20	40
3	ME 911	Metal Forming	4	0	0	4	20	20	20	40

III Semester

S. No.	Subject Code	Subject Name	L	T	P	Credit	Distribution of marks out of 100			
							TA	I Mid Exam	II Mid Exam	End Sem Exam
1.	ME 921	Thermo fabrication Processes	4	0	0	4	20	20	20	40
2.		Elective I	4	0	0	4	20	20	20	40

IV Semester

S. No.	Subject Code	Subject Name	L	T	P	Credit	Distribution of marks out of 100			
							TA	I Mid Exam	II Mid Exam	End Sem Exam
1	ME 909	Robotics	0	4	0	4	20	20	20	40
2		Elective-II	4	0	0	4	20	20	20	40

Semester V

S. No.	Subject Code	Subject Name	Credit	Eval %
1	ME 998	State of the art seminar	4	S/X
2	ME 999	Thesis	12	S/X

Semester VI

S. No.	Subject Code	Subject Name	Credit	Eval %
1	ME 999	Thesis	16	S/X

M.TECH. I SEMESTER SYLABUS

ME 901: FINITE ELEMENT METHOD

Approaches of FEM- Discrete, Variational and Weighted Residual; **Direct Problems-** Spring, Hydraulic Network; Resistance Network and Truss Systems; **1-D Field and Beam Bending Problem**s-Formulation using Galerkin and Raleigh-Ritz approaches, Derivation of elemental equations and their assembly, Solution and its post processing; **2-D and Axisymetric Field and Stress Problems**-Formulation using Galerkin and Raleigh-Ritz approaches, Derivation of elemental equations and their assembly, Solution and its post processing; **3-D Field and Stress Problems-** Formulation using Galerkin and Raleigh-Ritz approaches, Derivation of elemental equations and their assembly, Solution and its post processing; Eigen value and time dependent problems; Discussion about preprocessors, postprocessors and finite element packages.

M E 903: COMPUTERS AIDED MANUFACTURING

Fundamentals of Numerical Control: Need and future of NC Systems, Principles and Types of NC, Design Features of NC M/c Tools; Machining Centre; **NC Part Programming:** Manual, computer Assisted-APT, EXAPT, ADAPT and CAD based Part Programming; **Feedback Devices-**Resolvers, Encoders, and Inductosyns; **Actuation Systems-** Hydraulic, Pneumatic and Electromechanical**; Computer Control and Adaptive Control System-**CNC, DNC and AC; **Flexible Manufacturing Systems-** Concept and Classification, Types of Flexibility, pallets, fixtures, work handling systems, simulation and analysis in the design of FMS; **Concurrent Engineering-**Objectives, tools and applications; **Automated Quality Control Systems-**Working, Programming and Applications of CMM

ME 912: PRODUCTION AND OPERATIONS MANAGEMENT

Introduction: Flexible production era, Evaluation of service organization, learning curve, BPR; **Statistical Decision tools:** Frequency Distribution, Discrete and continuous distributions, e.g. Binomial, Poisson and Normal distributions, Exponential distribution, Hyper geometric distribution and Markovian Chain; Elementary theory and practice of sampling, Standard errors of means and variance, Tests of significance, χ^2 - test, Student t-test, F & Z -tests and their applications, Analysis of Variance (ANOVA), Introduction to Experimental Design; Linear regression and correlation, Elements of statistical inference and estimation theory applied to engineering problems; **Forecasting:** Elements and steps in forecasting, Types of forecasting: Qualitative and quantitative types,; Errors in forecasting; **Aggregate Planning:** Purpose, inputs of aggregate plan, planning, processes and strategies, Methods and techniques, Mathematical charting and heuristics; **Operation Scheduling:** Scheduling systems, scheduling methods, in flow and job-shops, Line of balance; **Capacity Planning**: Definition and measurement of capacity, Adjusting capacity, capacity strategies; **Facility Location and Layout:** facility location methods Mathematical and simulation Layout type optimization: quantitative and

qualitative methods; **Supply-Chain Management**: Creating and effective supply chain, supply chain strategy, performance measurement outsourcing; **Total quality Management:** Quality cost, quality classification. Statistical process control Taguchi robust design, Bench marking, QFD cost of quality; **Inventory system dependent Part demand:** MRP, Lot sizing in MRP Implementing MRP systems, MRP II, ERP

ME 921: THERMOFABRICATION PROCESSES

THERMOFABRICATION INTRODUCTION: Need and Classifications of Thermofabrication Processes**; METAL CASTING:** Need and Limitations; Classification of Casting Processes; Sand Mould Casting: Classification of foundry sands; Composition, Properties and Testing of Moulding Sand; Design of Pattern and Core; Parting Line Design; Gating System Design-Types of gating systems; Design of pouring basin, sprue, runner and ingate; Mould filling velocity and time including friction and velocity distribution in the conduit; Determination of solidification time of castings; Riser design and Placement; Description of Precision Sand Mould Casting Processes; Metal Mould Casting: Preparation of metal mould; Determination of solidification time of castings; Description of Die Casting, Centrifugal casting and Continuous Casting; **METAL WELDING:** Need and Limitations; Classification of Welding Processes; Arc Welding-Characteristics of arc and mode of metal transfer; Welding fluxes and coatings; welding machine characteristics-conventional and pulsed power sources, inverter type; Working and Modeling of arc welding processes; Resistance Welding-Principles and technology; power sources; Modeling of resistance welding processes; Beam Welding–Working and modeling of Laser Beam Welding and Electron Beam Welding; Solid Welding–Modeling and analysis of Friction Stir Welding, Explosive welding and Ultra-sonic welding, Weldability of cast iron, plain carbon and low alloy steels, stainless steels, Defects and Inspection of welds; Weld cracking and prevention; **POWDER METALLURGY:** Production of metal powders; Blending and Mixing; Compacting and Sintering; Densification and Sizing; Impregnation and Infiltration; Advances in powder metallurgy-Isostatic pressing, Hot pressing and Spark sintering

M.TECH. II SEMESTER SYLABUS

ME 908: OPTIMIZATION TECHNIQUES

Introduction: Terminology, Design Variables, Constraints, Objective Function, Variable Bounds, Problem Formulation, Engineering Optimization Problems, Calculus method, Linear Programming- Simplex method, Concept of Duality

Single Variable Optimization Problems: Optimality Criterion, Bracketing Methods: Region Elimination Methods: Interval Halving Method, Fibonacci Search Method, Golden Section Method, Successive Quadratic Estimation Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method, Application to Root finding

Multivariable Optimization Algorithms: Optimality Criteria, Unidirectional Search, Direct Search Methods: Hooke-Jeeves pattern search method/ Powell's Conjugate Direction Method. Gradient Based Methods: Any two of the following: Cauchy's Steepest Descent Method, Newton's method, Marquardt's Method, Variable-metric (DFP) Method

Constrained Optimization Algorithms: Kuhn Tucker conditions, Transformation Methods: Penalty Function Method, Method of Multipliers (MOM), Sensitivity analysis

Specialized Algorithms: Integer Programming, Penalty Function Method, Branch and Bound Method, Geometric Programming, Applications
Design of experiments and Taguchi method – Application and problem solving.

ME 909 : ROBOTICS

Introduction: Past, Present & Future; Robot Terminology; Applications, Components and Subsystems; Classification of Robot, End Effectors, Different types of grippers and design concepts; **Robot Kinematics:** Object location; Homogenous., Transformations, Direct and Inverse Kinematics, Manipulator motion, **Robot Drives, Actuators and Control:** Drive systems Hydraulic, Pneumatic and Electrical : DC Motor, Stepper Motor, Robot Motion and Path control, controller. **Sensors and Perception:** Types of sensors, vision system. Computer Interfaces.

ME 910: MACHINING SCIENCE

MACHINING INTRODUCTION: Need and Classifications of Machining Processes; Types of Study in Machining Processes-Experimental and Theoretical; **CONVENTIONAL MACHINING:** Mechanics of Metal Cutting: Chipping action; Cutting parameters; Orthogonal and Oblique cutting; Mechanism and Types of chips; Cutting forces and Stresses; Power and Energy; Heat and Temperature; Tool Materials and Tool Life; Tool Geometry and Mechanics of Turning, Drilling and Milling; **ABRASIVE MACHINING:** Mechanics of Metal Grinding: Grinding Wheel and Chip Formation; Grinding Forces and Power; Grinding Temperature; Advanced Abrasive Processes; **NONCONVENTIONAL MACHINING:** Need and Classification; Process Principle, Applications, Equipments, Process Analysis and Tool Design of Electro-Discharge Machining (EDM); Electro-Chemical Machining (ECM); Ultra-Sonic Machining (USM); Process Principle, Applications and Equipments for Beam Machining Processes (LBM, EBM and PBM); Jet Machining Processes: (AWJM, AJM and WJM), Chemical Machining Processes (CHM,CHB and PCM); Combined Machining Processes; **MICROMACHINING:** Need and Classification; Process Principle and Applications of Conventional Micromachining, Abrasive Micromachining, Nonconventional Micromachining and Combined Micromachining

ME 911: METAL FORMING

FORMING INTRODUCTION: Need and Classifications of Forming Processes, Types of Study of Forming Processes: Experimental and Theoretical; **CONVENTIONAL FORMING PROCESSES:** Massive metal and Sheet metal forming-Comparisons; Fundamentals of Plastic Deformations: Elastic and Plastic Deformation, Yielding Criterion and Flow Rules; Plastic Anisotropy and Viscoplasticity; Concept of solid and flow formulations; Plastic Deformation Analysis Techniques-Slab Method, Upper Bound Method and Slip Line Method; Analysis (using Slab, Upper Bound and Slip Line Method) of: Plain strain Problems: Drawing of Sheet and Extrusion of Plate, Rolling of Plate and Forging of Strip; Axisymmetric Problems: Drawing of Wire and Extrusion of bar and tube, Forging of Solid and Hallow Disc; Bending and Deep Drawing; **UNCONVENTIONAL FORMING PROCESSES:** Need and Classification; Process Principle, Applications, Equipments, Process Analysis and Die Design of Explosive

Forming; Electro-Magnetic Forming ; Electro-Hydraulic Forming; Laser Beam Bending and Laser Assisted Deep Drawing; **MICRO FORMING PROCESSES:** Need and Classification; Process Principle and Applications of Conventional Micro-Forming Processes and Unconventional Micro-Forming Processes.