



Scheme of Instruction & Syllabi of

Master of Technology In

Mechanical Engineering

(Specialization in Production Engineering)

I and II Year

(Effective from 2015-16)

**INVERTIS UNIVERSITY, BAREILLY
M. TECH (MECHANICAL ENGINEERING)
(SPECIALIZATION IN PRODUCTION ENGINEERING)
EFFECTIVE FROM 2015-16**

INVERTIS UNIVERSITY, BAREILLY
YEAR I, SEMESTER-I

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credits
						SESSIONAL EXAM.			E-SEM		
			L	T	P	CT	TA	TOTAL			
1	MPE-101	Modern welding Techniques	3	1	0	20	10	30	70	100	4
2	MPE-102	Foundry Technology	3	1	0	20	10	30	70	100	4
3	MPE-103	Modern methods of manufacturing	3	1	0	20	10	30	70	100	4
4	MPE-104	Metal Forming Technology	3	1	0	20	10	30	70	100	4
5	MPE-151	Seminar 1	0	4	0	-	-	50	-	50	2
Total			12	8	0	-	-	-	-	450	18

YEAR I, SEMESTER-II

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credits
						SESSIONAL EXAM.			E-SEM		
			L	T	P	CT	TA	TOTAL			
1	MPE-201	Mathematical Modeling and Optimization	3	1	0	20	10	30	70	100	4
2	MPE-202	Production Planning and Control	3	1	0	20	10	30	70	100	4
3	MPE-203	Advanced Machine Tool Design	3	1	0	20	10	30	70	100	4
4	MOE-20?	Elective 1	3	1	0	20	10	30	70	100	4
3	MPE-251	Seminar 2	0	4	0	-	-	50	-	50	2
Total			12	8	0	-	-	-	-	450	18

YEAR II, SEMESTER-III

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credits
						SESSIONAL EXAM.			E-SEM		
			L	T	P	CT	TA	TOTAL			
1	MOE-30?	Elective 2	3	1	0	20	10	30	70	100	4
2	MOE-30?	Elective 3	3	1	0	20	10	30	70	100	4
3	MPE -351	Seminar 3	0	4	0	-	-	50	-	50	2
4	MPE-352	Preliminary Thesis	0	16	0	-	-	200	-	200	8
Total			6	22	0	-	-	-	-	450	18

YEAR II, SEMESTER-IV

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credits
						SESSIONAL EXAM.			E-SEM		
			L	T	P	CT	TA	TOTAL			
1	MPE-451	THESIS	0	16	0	-	-	100	300	400	16
Total			0	16	0	-	-	-	-	400	16

List of Electives-1 (MOE-20?)

1. Materials management
2. Quality Engineering
3. Renewable Energy Systems
4. Total Quality Management
5. Product design and development
6. Industrial metrology and inspection
7. Advanced composite materials
8. Theory of vibration

List of Electives-2 (MOE-30?)

1. Design of manufacturing and assembly
2. CNC machines and computer aided inspection
3. Computer integrated manufacturing
4. Non conventional methods of manufacturing
5. Cutting tool engineering
6. Advance casting and welding technologies
7. Hydraulics and pneumatics for production
8. Machine Tool Dynamics

List of Electives-3 (MOE-30?)

1. Design of manufacturing and assembly
2. CNC machines and computer aided inspection
3. Computer integrated manufacturing
4. Non conventional methods of manufacturing
5. Cutting tool engineering
6. Advance casting and welding technologies
7. Hydraulics and pneumatics for production
8. Machine Tool Dynamics
9. Materials management
10. Quality Engineering
11. Renewable Energy Systems
12. Total Quality Management
13. Product design and development
14. Industrial metrology and inspection
15. Advanced composite materials
16. Theory of vibration

MPE -101 MODERN WELDING TECHNIQUES

Maximum Sessional Marks: 30

Maximum End Term Examination Marks: 70

L T P-3 1 0

MODULE 1

Classification of welding processes; Gas welding; Arc welding; arc physics, power source characteristics, Manual metal arc welding: Concepts, types of electrodes and their applications, Gas tungsten arc welding: Concepts, processes and applications ; gas metal arc welding, Concepts, processes and applications ,types of metal transfer, CO2 welding.

MODULE 2

Submerged arc welding, advantages and limitations, process variables and their effects, significance of flux-metal combination, modern developments, narrow gap submerged arc welding, applications; electro slag and electro gas welding

MODULE 3

Plasma welding; Concepts, processes and applications, keyhole and puddle-in mode of operation, low current and high current plasma arc welding and their applications; Resistance welding, Concepts, types and applications, Flash butt welding, Stud welding and under water welding

Reference Books:

1. Parmer R. S., 'Welding Engineering and Technology', Khanna Publishers, 1997
2. Cary, Howard, "Modern Welding Technology', prentice Hall, 1998

MPE-102 FOUNDRY TECHNOLOGY

Maximum Sessional Marks: 30

Maximum End Term Examination Marks: 70

L T P-3 1 0

MODULE-1

Critical review of some foundry operations: Various casting processes, mould reinforcements, mould factors in metal Flow, molding factors in casting design, limitations in controlling some molding factors in casting design, Effect of process variables on property of core and mould making sand. Properties of liquid metals: Thermal properties, viscosity, surface tension and density of liquid metals and their

role in foundry technology. Gases in liquid metals: Simple gases in metals, complex gases in metals, gas defects and their control.

MODULE-2

Solidification of metals and alloys: Structure of casting as influenced by alloy constituents, thermal conditions, inherent nucleation and growth condition in the liquid like temperature gradient, liquids temperature profile and G/R ratio. Control of structure; principles of gating and rise ring, Directionality in solidification, Characteristics of different alloys, Design of gating system, Wlodawer system of determining the feeder head requirements. Feeder head efficiency, concept of feeding range, use of supplementary techniques and introduction of design modifications.

MODULE-3

Special casting processes: Investment casting, Die casting, centrifugal casting, full mould casting, vacuum shield casting etc. Industrial melting practices: Aim of melting and melting practices as adopted in case of Cast Irons, Steel, Cu, Al and its alloys. Casting defects & their remedies: Shaping faults arising in pouring, Inclusions and sand defects, gas defects, shrinkage defects during solidification in liquid phase. Contraction defects, Dimensional errors, compositional errors and segregation.

Reference Books:

1. Beeley, P.R., Foundry Technology, Butterworth and Co.
2. Webster, P.D., Fundamentals of Foundry Technology,
3. Mukherjee, P.C, Fundamentals of Metal casting Technology

MPE-103 MODERN METHODS OF MANUFACTURING

Maximum Sessional Marks: 30

Maximum End Term Examination Marks: 70

L T P-3 1 0

MODULE 1

Introduction to machining: Classification of machining processes, comparison between conventional and non-conventional machining processes, requirements of tool materials, Developments in tool materials, ISO specifications for inserts and tool holders, Tool life, Optimization of tool lie parameters for machining. Laser beam machining: Introduction to laser beam machining, process parameters, machining

applications of laser, advantages and limitations of laser beam machining. Electron beam machining: Introduction to laser beam machining, equipment and process parameters used in machining, advantages and disadvantages of laser beam machining.

MODULE 2

Mechanical machining processes: Abrasive jet machining: Introduction, Equipment, variables in abrasive jet machining: carrier gas, type of abrasive, size of abrasive grain, velocity of abrasive jet, Mean abrasive particles per unit volume of carrier gas, work material stand off distance, nozzle design. Process characteristics – material removal rate, accuracy and surface finish, Advantages, disadvantages and applications of abrasive jet machining.

Ultrasonic machining: Introduction, equipment details, tool material and tool size, abrasive slurry, tool cone (concentrator), exponential concentrator of circular cross section and rectangular cross-section, hollow cylindrical concentrator. Effect of various process parameters, applications, advantages and disadvantages of ultrasonic machining. HERF techniques, Super plastic forming techniques, Principles and Process parameters, Advantages, applications and limitations of HERF techniques, Orbital forging, Isothermal forging

MODULE 3

Electrochemical machining: Introduction to Electro-chemical machining, Study of ECM machine, Elements of ECM process: cathode tool, anode work-piece, source of DC power, electrolyte, process characteristics-Material removal rate, Accuracy, surface finish, Economics of ECM, applications, limitations, advantages and disadvantages of electrochemical machining.

Electric Discharge Machining: Introduction to electric discharge machining, mechanism of metal removal, dielectric fluid, spark generator, tool material (electrodes), electrode feed control, electrode wear, electrode tool design: Choice of matching operation, electrode material selection, under sizing and length of electrode, machining time. Flushing – pressure flushing synchronized with electrode movement, process characteristics: material removal rate, accuracy, surface finish, heat affected zone, travelling wire EDM, applications.

Reference Books:

1. Metal Cutting Principles M.C. Shaw Oxford Clarendon Press
2. Modern Machining Process – Pandey and Shahn, TATA Mc Graw Hill 2000.
3. Fundamentals of Metal Cutting and Machine Tools B.L. Juneja and G.S. Sekhon New Age International

Revised and updated 1

4. Fundamentals of Metal Casting H. Loper and Rosenthal Tata McGraw Hill

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effects

Causes and remedies of important forming defects

Miscellaneous Forming Processes

Advantages and disadvantages of Hot and Cold Forming

Module III

Mechanics of Forming Processes

Determination of rolling pressure, rolling separating force, forging of strip, forging of disc, Determination of drawing force and power, Determination of maximum allowable reduction,

Deep Drawing, bending determination of work load, Extrusion determination of work load and stress analysis

Reference Books:

1. Manufacturing Science by Gosh and Mallik
2. Manufacturing Engineering and Technology by Kalpakjian & Schmid
3. Technology of metal forming processes by Surender Kumar
4. Manufacturing Processes and Technology Dr.B.Kumar

MPE-201 MATHEMATICAL MODELING AND OPTIMIZATION

Maximum Sessional Marks: 30

Maximum End Term Examination Marks: 70

L T P-3 1 0

Module 1

General concepts

Evolution of modern management, functional approach, systems approach, decision making, models and model building, models to solve production problems.

Linear programming

General L. P. Format, formulation of production problems, Methods of Solution: Graphical, Simplex, Modified simplex, Big M and 2 Phase methods, Duality, degeneracy and redundancy in L.P., Sensitivity analysis, Application of L.P. to solve problems of Production systems.

Module 2

Network analysis

CPM and PERT, Shortest path problem, Maximum flow problem, Concept of slack/float and its significance, Project cost analysis, crashing, resource smoothing and leveling, Applications in production systems.

Sequencing problem

Johnson's Rule and its logic, methods of solution, n jobs two machines, n jobs 3 machines, 2 jobs M machines and n jobs M machines problems, Graphical and Heuristic methods, Applications and limitations.

Module 3

Queuing Models

Simple queues, Type of queuing models, multiple service channels, Arrival and service characteristics, Optimization of queuing systems, Application to production problems on queuing theory.

Taguchi method

Trial and error approach, Difference between trial and error approach and taguchi optimization approach, design of experiments, Taguchi method, optimization strategies using taguchi method.

Reference Books:

1. Introduction to optimum design—Jasbir S. Arora, -- Elsevier, 2006.
2. Engineering optimization: Methods and Applications – A Ravindran, K.M. Ragsdell, and G.V. Reklaitis , Wiley India Edition, 2006.

MPE-202 PRODUCTION PLANNING AND CONTROL

Maximum Sessional Marks: 30

Maximum End Term Examination Marks: 70

L T P-3 1 0

MODULE 1

Introduction: Objectives and benefits of planning and control-Functions of production control-Types of production job batch and continuous Product development and design-Marketing aspect, Functional aspects, Operational aspect, Durability and dependability aspect, aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis.

Workstudy: Method study, basic procedure , Selection , Recording of process , Critical analysis, Development Implementation , Micro motion and memo motion study , work measurement , Techniques of work measurement, Time study Production study Work sampling.

MODULE 2

Product planning and process planning: Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning, batch production.

Production scheduling : Production Control Systems-Loading and scheduling, Scheduling rules, Gantt charts, Basic scheduling problems Line of balance , Flow production scheduling, Batch production scheduling-Product sequencing - Production Control systems-Periodic batch control-Material requirement planning – Dispatching-Progress reporting and expediting-Manufacturing lead time.

MODULE 3

Inventory control and recent trends in ppc: Inventory control- Purpose of holding stock- Effect of demand on inventories - Ordering procedures. Ordering cycle system - Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP.

Reference Books:

1. Martand Telsang, "Industrial Engineering and Production Management", S. Chand and Company, First edition, 2000.
2. James.B.Dilworth , " Operations management – Design, Planning and Control for manufacturing and services" McGraw Hill International edition 1992.

REFERENCES:

1. Samson Eilon, "Elements of production planning and control", Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K. Sarin , "Modern Production / Operations Management", 8th Ed. John Wiley and Sons, 2000.
3. Kanishka Bedi, "Production and Operations management", Oxford university press, 2nd Edition 2007.
4. Melynk, Denzler, "Operations management – A value driven approach" Irwin McGraw-Hill.
5. Norman Gaither, G. Frazier, "Operations management" Thomson learning 9th edition IE , 2007
6. K.C.Jain & L.N.Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 1990.

7. S.N.Chary, "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.

8. Upendra Kachru, "Production and operations management – Text and cases" Excel books 1st edition 2007

MPE-203 ADVANCED MACHINE TOOL DESIGN

Maximum Sessional Marks: 30

Maximum End Term Examination Marks: 70

LT P- 3 1 0

MODULE 1

Classification of Machine Tools: General purpose, Special purpose, Automatic, Semi-Automatic machine tools, Transfer lines. Kinematics of Machine Tools: Shaping of geometrical and real surfaces, Developing and designing of kinematics schemes of machine tools, Kinematic structures of lathe, drilling, milling, relieving lathe, grinding, gear shaping and gear hobbling machining. Kinematic design and speed and feed boxes. Productivity loss, stepped and step less regulation.

MODULE 2

General Kinematics – Design of drives and machine tool elements, design of tool changes and turrets. Machine tool dynamics -Thermal aspect in machine tool design machine tool noise and concepts of noise control. Design of slide ways - application of new materials treatment of slide ways. CNC machine tool structures. Static and dynamic testing of machine tools recent trends in machine tool design.

MODULE 3

Automatic machine tools and Transfer machines with control systems: Selection of control systems, Control systems with pre-selection of speeds or feeds, Remote controls, Safety devices in machine tools. Significance of Machine tool automation, working members, Application of CAD/CAM/CIM in Machine tool design, Transfer machines & their controls

Hydraulic & Pneumatic Systems for machine tools: General principles of Hydraulic and Pneumatic drives. Different types control valves for Hydraulic and Pneumatic circuits, Hydraulic & Pneumatic circuit design for machine tools.

Reference Books:

1. M. Weck, "Handbook Of Machine Tools, Vol. 1-4", John Wiley, USA. 1980.
2. Cyril Donaldson, G.H.LeCain & V.C. Goold, "Tool Design", Tata McGraw Hill, 1973.

3. J. Tlustý & F. Koenigsbeger, "Machine Tool Structure, Vol. I", Pergamon press, UK, 1970.
4. Pippenger, John J. and Koff Richard M, "Fluid Power Controls", McGraw Hill, 1959.
5. Pippenger, John J. and Hicks, Tyler G, "Industrial Hydraulics", McGraw Hill, 1979.
6. Leskiewicz H.J. and Zarhmba M., "Pneumatic and Hydraulic components and Instrumentations in Automatic Controls", International Federation of Automatic controls, 1980.
7. Acherkan N., "Machine Tool Design", Vol. I – IV , Mir Publications.
8. Mehta, N.K., "Machine Tool Design", Tata McGraw Hill, 1989.

MOE-201 MATERIALS MANAGEMENT

Maximum Sessional Marks: 30

Maximum End Term Examination Marks: 70

L T P-3 1 0

MODULE-1

Materials Management: Definition and function -Importance of materials management. Objective of Materials management – Materials requirement and planning – Inventory control – Fixed order size, P&Q Inventory System – Deterministic probabilistic models, Static inventory models – Spare parts management – Materials requirement planning – Aggregate inventory management – , ABC Analysis, XYZ Analysis, VED Analysis, FSN Analysis, SDE Analysis.

MODULE-2

Inventory Management: Stages; Selective Control; Demand Forecasting; Leadtime; Safety Stock; MRP and JIT systems; Inventory Valuation-Inventory Control: Relevant Costs, P & Q Systems of Inventory, Basic EOQ Model, and Model with Quantity discount, Economic Batch Quantity. Safety Stock, Concept of Quality Management, Quality of Design, supply, Concept of supply chain management, Statistical Quality Control, X Bar, R and P Charts

MODULE-3

Store management: Store keeping and materials handling - Objectives - Function – Standardization- stores layout, storage systems and equipment, stores preservation, stores procedures- store keeping – stores responsibilities - Location of store house - Centralized store room - Equipment – security measures - Protection and prevention of stores

Revised and updated 1

Purchase management: Purchasing - Procedure - Dynamic purchasing - Principles – import -Purchasing function – Purchasing policies and procedures, legal aspects of purchasing, tax considerations in purchasing, selections and sources of supply and make or buy decisions – Vendor evaluation and rating – vendor development.