VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

CHOICE BASED CREDIT SYSTEM (CBCS)

SCHEME OF TEACHING AND EXAMINATION FOR 2016 - 17

M.TECH.-PRODUCTION MANAGEMENT (MPM)

I Semester:

Subject Code	Name of the Subject	Teaching hours / week		Duration of Exam in Hrs	Marks for		Total Marks	Credits
		Lecture	Practical / Field work / Assignment / Tutorials		I.A	Exam		
16MPM11	Theory of Metal Cutting	4	-	3	20	80	100	4
16MPM12	Quantitative Techniques in Decision Making	4	-	3	20	80	100	4
16MPM13	Theory of Metal Forming	4	-	3	20	80	100	4
16MPM14	Computer Integrated Manufacturing and Automation	4	-	3	20	80	100	4
16MPM15X	Elective – I	3	-	3	20	80	100	3
16MPM16	Lab Component – I	-	3	3	20	80	100	2
16MPM17	Seminar	-	3	-	100	-	100	1
Total		**19**	**6**	**18**	**220**	**480**	**700**	**22**

Elective – I	
16MPM151	Quality and Reliability Engineering
16MPM152	Tool Engineering
16MPM153	Supply Chain Management
16MPM154	Advanced Materials & Processing

THEORY OF METAL CUTTING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	**16MPM 11**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

Course Objective: The student will learn to

1 Understand the mechanics of chip formation, Geometry, tool material and tool life.

2 Get an exposure on dynamometers for measuring cutting forces

3. Understand the Thermal Aspects and selection of cutting fluids.

4. Analyze the Cutting speed and Cost of machining with advanced techniques.

MODULES	**Teaching Hours**
MODULE- 1	
MECHANICS OF METAL CUTTING: Mechanism of chip formation, Orthogonal & Oblique cutting, types of chips, built-up edge, Determination of shear plane angle, forces on the chips, forces in orthogonal cutting, Merchant circle diagram and analysis, Theory of Lee & Shaffer, co-efficient of friction, power & energy relationship, velocity relationship, shear-strain, factors affecting forces and power, problems **GEOMETRY OF CUTTING TOOLS:** Single point and multi point cutting tools, tools nomenclature, tool point reference systems, tool signature, Recommended tool angles, Effect of cutting parameters on tool geometry	**10 Hours**
MODULE- 2	

TOOL MATERIALS AND THEIR PROPERTIES: Characteristics of tool materials, types of tool materials – carbon tool steels, high speed steels, cast alloys, cemented carbides, ceramics, diamonds, SIALON, CBN, UCON, recommended cutting speeds for the above tools, discussion on die steels, air, water, oil hardening of tools and their applications **TOOL WEAR, TOOL LIFE:** Mechanisms of tool wear, Sudden & gradual wear, crater wear, flank wear, tool failure criteria, tool life equations, effect of process parameters on tool life, tool life tests, conventional & accelerated tool wear measurement, machinability index	**10 Hours**
MODULE- 3	
MEASUREMENT OF CUTTING FORCES: Reasons for measuring cutting forces, Classification of cutting force dynamometers – mechanical, hydraulic, pneumatic, optical, inductance, piezoelectric, and strain gage type dynamometers, **DYNAMOMETERS FOR MACHINE TOOLS:** dynamometers for lathe, drilling, grinding and milling, Calibration of dynamometers	**10 Hours**
MODULE- 4	
Thermal Aspects in Metal Cutting: Heat sources in metal cutting, temperature in chip formation, temperature distribution, and experimental determination of tool temperatures. **CUTTING FLUIDS:** Basic actions of cutting fluids, properties of cutting fluids, selection of cutting fluids, application of cutting fluids, filtration of fluids, recommended cutting fluids.	**10 Hours**
MODULE- 5	
ECONOMICS OF MACHINING: Introduction, elements of total production cost, optimum cutting speed and tool life for minimum cost, optimum cutting speed and tool life for maximum production, problems. **ADVANCED MACHINING TECHNIQUES**: cryo machining & high speed machining. Causes of vibration and chatter in machining, and	**10 Hours**

their remedy	

Course Outcomes:

On completion of the course the student will be able to

1. Analyze the Mechanism of chip formation, Geometry, tool material and tool life.
2. Use dynamometers for measuring cutting forces.
3. Analyze the Thermal Aspects and selection of cutting fluids.
4. Calculate the Cutting speed and Cost of machining with advanced techniques.

Question paper pattern:

1. The question paper will have ten questions.
2. Each full question consists of 16 marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Metal Cutting Principles - M.C. Shaw - Oxford Publication – 1985.

2. Fundamentals of metal cutting & Machine Tools-by B.L.Juneja& G.S–Sekhar -Wiley Eastern.

3. Metal Cutting - V.C.Venkatesh&S.Chandrasekhanan - Pantice Hall – 1991.

4. Metal Cutting - Dr. B.J.Ranganath -Vikas Publications

QUANTITATIVE TECHNIQUES IN DECISION MAKING [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I			
Subject Code	**16MPM12**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
Course Objective: The student will learn to: 1. Understand statistics and its importance for making managerial decisions 2. Formulate a real-world problem as a mathematical programming model 3. Understand the mathematical tools that are needed to solve optimization problems 4. Construct a project network and apply PERT and CPM techniques. 5. Illustrate how Markov chains can solve standard business problems.			
Modules			Teaching Hours
Module- I			
Introduction: Statistics and managerial decisions, statistical data and Operations Research techniques. **Fundamentals of Statistics, probability and probability distributions**: Measures of central tendency and location, Measure of dispersion, skewness and kurtosis, Probability and rules of probability, Random variables and probability distributions - Binomial, Poisson, Hyper geometric and Normal.			08 Hours
Module- 2			
Linear Programming Problem: Formulation of L.P.P., Solution of L.P.P. by graphical method, Solution of L.P.P. by simplex method, Concept of duality and solution of dual problems, Solution of L.P.P. by dual simplex method.			10 Hours
Module- 3			

Transportation Problems: Structure of transportation problem finding Initial Basic feasible solution by North-West Corner method, Least-Cost Method and Vogel's Approximation method(VAM)., Optimality test of transportation problems by MODI method, Solution of degeneracy and unbalanced transportation problems, **Assignment Problems**: Assignment problems and solution by Hungarian method and Traveling Salesman problem.	10 Hours
Module- 4	
Theory of Games: Two person zero sum game, Minimax&maximin strategies, Solution of game by dominance rules, arithmetic and algebraic methods, Solution of game by graphical method and method of matrices, Solution of game by Linear programming approach and approximate method to solve game problems. **Waiting Line**: Basic structure of queuing systems and characteristics, Expressions for M/M/l queuing model.	10 Hours
Module- 5	
Network Analysis: PERT and CPM, Network construction and determination of critical path, Calculation of ES, EF, LS, LF, TF, FF and IF, Crashing of a project, Scheduling of a project and resource leveling. **Simulation of Management systems:** Simulation and Monte Carlo method, Waiting line and inventory simulation models	12 Hours

Course Outcomes:

On completion of the course the student will be able to :

1. Understand the basic statistical measures of Central Tendency and Dispersion.
2. Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry
3. Formulate a managerial decision problem into a mathematical model
4. Understand Operations Research models and apply them to real-life problems
5. Design new simple models, like: CPM, PERT to improve decision making and develop critical thinking and objective analysis of decision problems

Question paper pattern:

5. The question paper will have ten questions.
6. Each full question consists of 16 marks.

7. There will be 2 full questions (with a maximum of four sub questions) from each module.
8. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. **Quantitative Techniques for managerial decisionsm -** Srivastava U.K. - New Age International Private Limited - ISBN Number: 8122401899.
2. **Operations Research -** H. Taha- Prentice Hall India – 8 Edition.

Reference Books:

1. Operations Research: An Introduction - Gupta and Heera - S.Chand and Company - 2002

2. **Introduction to Operations Research -** Hillier and Liberman- McGraw Hill International. - ISBN 10: 0072321695.

THEORY OF METAL FORMING [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I			
Subject Code	**16MPM13**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

Course Objective: The student will learn to

6. Understand Basic concepts of metal forming
7. Understand the types of forging operations, types of friction and defects.
8. Understand the types of rolling mills, geometrical relationships and its defects.
9. Understand extrusion processes and relationships, Drawing and its defects.
10. Understand the types of sheet metal processes and methods of HERF.

MODULES	Teaching Hours
MODULE- 1	
INTRODUCTION TO FORMING PROCESS: Introduction to metal forming, Effect of temperature on forming process-hot working, cold working. Effect of Metallurgical structure, Effect of speed of deformation work of Plastic deformation, Friction in forming operation. Concept of true stress and true strain, uniaxial, biaxial, triaxialstresses,Vonmoises criteria ,tresca criteria, principle stresses, concepts of plane stress and plane strain and problems	08 Hours
Module- 2	
Forging: Classification, various stages during forging, Forging equipment, brief description, deformation in compression, forging of slabs, discs with respect to sticking, sliding and mixed friction forging defects. Residual stresses in forging and problems.	12 Hours
Module- 3	
Rolling of Metals: Classification, forces and geometrical relationships in rolling. Expression for rolling load, roll separating force.	10 Hours

Variables in rolling: Deformation in rolling, Defects in rolled products, Residual stresses in rolled products. Torque and Horsepower and problems.	
Module- 4	
Extrusion: Classification, Extrusion equipment, variables in extrusion, Deformation in extrusion, Extrusion defects, Work done in extrusion and problems **Drawing**: Principles of Rod and wire drawing, variables in wire drawing, Residual stresses in rod, wire and tube drawing, Defects in Rod and wire drawing and problems	12 Hours
Module- 5	
Sheet Metal forming: Introduction, Forming methods, shearing and Blanking, Bending, stretch forming, Deep drawing, redrawing operations, Defects in formed products **High Energy Rate Forming :** Introduction , explosive forming methods, hydro forming methods and electro magneto forming , applications, merits and de merits	08 Hours

Course Outcomes:

On completion of the course the student will be able to

6. Understand the basics of metal forming.
7. Recognize the importance of metal forging using different geometrical shapes and various defects.
8. Understand the concept of rolling ,types of rolling mills and processes and its defects
9. Understand the concepts of extrusion and drawing and their applications.
10. Understand the types of sheet metal forming processes and HERF.

Question paper pattern:

1. The question paper will have ten questions.
2. Each full question consists of 16 marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. **Mechanical MetalIurgy**- Dieter G.E. - McGraw Hill Publications.
2. **Principles of Metal Working** - R.Rowe - Amold London – 1965.
3. **Metals Handbook** – ASM - Volume II -.ASM
4. **Fundamentals of working of Metals -** Sach G. - Pergamon Press.

COMPUTER INTEGRATED MANUFACTURING & AUTOMATION

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	**16MPM14**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

Course Objectives: The course objective is to make students to familiarize:

11. The Basic components of CIM, CAD/CAM and its integration with CIM.
12. The analysisof automated flow lines with or without buffer storage capacity.
13. Principles of computer aided process planning and group technology.
14. Different monitoring systems used in CIM, Computer aided quality control & FMS.

MODULES	Teaching Hours
MODULE- I	
INTRODUCTION TO CIM: Manufacturing - Types, Manufacturing Systems, CIM Definition, CIMwheel, CIM components, Evolution of CIM, needs of CIM, Benefits of CIM. **HIGH VOLUME PRODUCTION SYSTEM**: Introduction Automated flow line-symbols, objectives, Work part transport-continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam, roller chain drive, Rotary-rack and pinion, Ratchet & Pawl, Geneva wheel, Buffer storage, control functions-sequence, safety, Quality.	12 Hours
MODULE- 2	

ANALYSIS OF AUTOMATED FLOW LINE & LINE BALANCING: General terminology and analysis, Analysis of Transfer Lines without storage-upper bound approach, lower bound approach and problems, Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with example problem, Partial automation-with numerical problem example, Manual Assembly lines line balancing problem.	08 Hours
MODULE- 3	
AUTOMATED PROCESS PLANNING: Group Technology, Part families, Part classification and coding, Production flow analysis, Machine cell design, Applications and Benefits of Group Technology, Structure of a Process Planning, Process Planning function, CAPP - Methods of CAPP, CAD based Process Planning, Inventory management - Materials requirements planning.	10 Hours
MODULE- 4	
MONITORING AND QUALITY CONTROL: Types of production monitoring system, process control & strategies, direct digital control - Supervisory computer control - computer aided quality control - objectives of CAQC, QC and CIM, contact, non-contact inspection methods, CMM and Flexible Inspection systems. Integration of CAQC with CIM.	10 Hours
MODULE- 5	
FLEXIBLE MANUFACTURING SYSTEMS: FMS concept, Components of FMS, FMS Layouts, FMS planning and implementation. Tool Management systems-Tool monitoring, Work holding devices- Modular fixturing, flexible fixturing,, flexibility, quantitative analysis of flexibility, application and benefits of FMS, automated material handling system –AGVs, Guidance methods, AS/RS.	10 Hours
Course Outcomes:	

After studying this course students will be able to :

1. Identify different production systems and integrate them into a computer integrated manufacturing system.
2. Discuss different high volume production systems and draw comparisons about their efficacy in automated systems.
3. Analyze automated flow lines with or without buffer storage capacity.
4. Elucidate different aspects of computerized planning and Computer aided quality control systems.
5. Explain concepts of Flexible manufacturing systems.

Question paper pattern:

5. The question paper will have ten questions.
6. Each full question consists of 16 marks.
7. There will be 2 full questions (with a maximum of four sub questions) from each module.
8. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Mikell P. Groover, Automation, Production system & Computer Integrated Manufacturing, Prentice Hall India Learning Private Limited, 3rd Edition, 2008.
2. Kant Vajpayee. S., Principles of Computer Integrated Manufacturing, Prentice Hall of India, 1999.

Reference Books:

1. James A. Rehg& Henry W Kraebber, Computer Integrated Manufacturing, Pearson Prentice Hall, 2005.
2. YoremKoren, Computer Control of Manufacturing Systems, Mc. Graw Hill, 1983.
3. P. Radhakrishnan, S. Subramanyan and V. Raju, CAD / CAM / CIM, New Age International Publishers, 2008.

QUALITY AND RELIABILITY ENGINEERING [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I			
Subject Code	**16MPM151**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
MODULES			**Teaching Hours**
MODULE- 1			
Basic Concepts: Definitions of quality and Reliability, Parameters and Characteristics, Quality control, statistical Quality Control, Reliability concepts. **Concepts in Probability and Statistics :** Events, Sample Space, Probability rules, Conditional probability, Dependent and Independent Events, Application of Probability concepts in Quality Control, Problems			**8 Hours**
MODULE- 2			
Statistical Aspects and Probability Distributions : Statistical Tools in Quality Control, The concept of Variation, Graphical Tools for data representation and analysis, Discrete and Continuous Distributions, Normal, Poisson, Binomial, Weibul Distribution, Problems **Control Charts:** Variable charts X chart, R chart, s chart, Attribute charts, P chart, NP chart, C chart.			**8 Hours**
MODULE- 3			
Failure Data Analysis : Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis. **Acceptance Sampling:** Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL, LTPD, AOQL.			**8 Hours**
MODULE- 4			
System Reliability: Series, parallel and mixed configuration, Block diagram concept, r-out-of-n structure solving problems using			**8 Hours**

mathematical models. **Maintainability and Availability:** Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems	
MODULE- 5	
Reliability Improvement and Allocation: Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, **Optimization:** Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems.	**8 Hours**

Question paper pattern:

9. The question paper will have ten questions.
10. Each full question consists of 16 marks.
11. There will be 2 full questions (with a maximum of four sub questions) from each module.
12. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. **The Assurances Sciences** - Halpern, Seigmund - Prentice Hall International, New Jersey, U.S.A - 1978.
2. **Quality Planning and Analysis** - Juran, J.M and Gryna, F.M. - Tata McGraw Hill publishing Coimpany Ltd., New Delhi, India – 1982.
3. **Logistics Engineering and Management** - Blanchard, Bejamin S. - Prentice Hall International, New Jersey, U.S.A – 1986.
4. **Maintainability and Reliability Handbook of Reliability Engineering and Management** - Kraus, John W Editors – Ireson. W.G. and Cooms, C.F. - McGraw Hill Book Company Inc. U.S.A – 1988.
5. **Concepts in Reliability Engineering** - Srinathm K.S. - Affiliated East-West Press Private Limited, New Delhi, India -1985.

TOOL ENGINEERING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	**16MPM152**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

Course Objectives: The student will

1. Acquire knowledge on cutting tool materials, tool geometry and mechanics of machining.
2. Learn intricacies involved in design of press tools and understand various tools used inpractice
3. Learnvarious gauges and measurement techniques, jigs and fixtures ,clamping methods, guiding elements
4. Acquire knowledge of various dies and moulds which helps them to analyze its suitability for variety of applications in industries.

Modules	Teaching Hours
Module- 1	
Cutting Tool Materials Introduction and desirable properties ,Carbon and Medium-Alloy Steels ,High-Speed Steels ,Cast-Cobalt Alloys ,Carbides ,Coated Tools, Alumina-Based Ceramics ,Cubic Boron Nitride, Silicon-Nitride Based Ceramics ,Diamond ,Reinforced Tool Materials ,Cutting-Tool Reconditioning. **Design of Cutting Tools** Basic Requirements ,Mechanics and Geometry of Chip Formation , General Considerations for Metal Cutting ,Design of single point Cutting Tools , Design of Milling Cutters ,Design of Drills and Drilling , Design of Reamers, Design of Taps, Design of Inserts , Determining Shank Size for Single-point Carbide Tools, Numerical Problems	08Hours
Module- 2	
Gages and Gage Design Limits fits and tolerances, Geometrical tolerances-specification and measurement., Types of gages ,Gage design, gage tolerances ,Material for Gages **Work Holding Devices** Basic requirements of work holding devices, Location: Principles, methods and	08 Hours

devices, Clamping : Principles, methods and devices	
Module- 3	
Drill Jigs Definition and types of Drill Jigs ,Chip Formation in Drilling ,General Considerations in the Design of Drill Jigs, Drill Bushings ,Drill Jigs, and Modern Manufacturing **Design of Fixtures** Fixtures and Economics , Types of Fixtures , Milling Fixtures , Boring Fixtures , Broaching Fixtures , Lathe Fixtures , Grinding	08 Hours
Module- 4	
Design of Press Tools Introduction to press tools and related terminology, effect of clearances, theory of deformation, stages of cutting operation, center of pressure, strap strip layout , die and punch design, design of simple, compound and progressive dies, methods of mounting punches and dies, design of drawing dies, bend allowances, bending and forming dies, Dies for diecasting and forging operations.	08 Hours
Module- 5	
Dies and moulds Bending:Types,Parts and functions of bending die,Definition, calculations and factors affecting bend radii, bend allowance and spring back,Method to compute bending pressure,Types, sketch, working and applications of bending dies,Drawing dies-types and method to determine blank size for drawing operation,Types, sketch, working and applications of drawing dies (embossing, curling, bulging, coining, swaging and hole flanging),Forging dies- terminology, types, sketch, working and applications.	08 Hours
Course Outcomes: **On completion of the course the student will be able to** 1. Select cutting tool materials and tool geometries for different metals. 2. Select the locating and clamping devices for given component. 3. Select and design jigs and fixtures for given simple component. 4. Classify and explain various press tools and press tools operations. 5. Select a die for a given simple component.	
Question paper pattern: 1. The question paper will have ten questions.	

2. Each full question consists of 16 marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books :

1. JOSHI P .H, “Jigs & Fixtures”, New Delhi -Tata McGraw Hill Pub. Co. Ltd., 11th print 1999.
2. D. Eugene Ostergaard,”Basic die design”, McGraw-Hill, 1963
3. P.C. Sharma, “A Text Book Of Production Engineering”, S. Chand Publisher, 2010

Reference Books:

1. ASTME, “Fundamentals of Tool Design”, Prentice Hall of India, 1983.
2. Donaldson, “Tool Design”, Tata-McGraw Hill, 3rd Edition, 2000.
3. An Introduction to Jig & Tool Design -KEMPSTER M.H.A.- Bristol- ELBS 3rd Ed.1974.
4. Die Design Hand Book -SMITH A. DAVID.SME 3rd edition, 1990.

SUPPLY CHAIN MANAGEMENT
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	**16MPM153**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

Course Objective: The student will learn to:

15. Understand the basic concepts of Supply Chain Management and identify SC drivers.
16. Discuss the role of each SC drivers play and their impact on SC performance.
17. Take simple Supply Chain and analyze it using concepts of SCM.

Modules	**Teaching Hours**
Module- I	
Introduction to supply chain management: Supply chain basics (Definition of SC, Objectives of SC, SC stages, SC flows, SC Examples), decision phases in a supply chain (SC Strategy or Design, SC Planning and SC Operation), supply chain efficiency and responsiveness. Process view of a supply chain (Cycle view, Push/Pull View), Supply Chain Macro Processes in a firm, drivers of supply chain performance (Facilities, Inventory, Transportation, Information and Sourcing), Supply Chain performance: Competitive and supply chain strategies, achieving strategic fit.	08 Hours
Module- 2	
Planning and Managing Inventories in a Supply Chain: Role of cycle inventory in a SC, Economies of scale to exploit fixed costs, Economics of scale to exploit quantity discounts, short-term discounting (Trade promotions). Role of safety inventory in a SC, safety inventory determination, Impact of supply uncertainty, aggregation and replenishment policies on safety inventory, Managerial levers to improve supply chain profitability.	08 Hours
Module- 3	

Designing distribution networks in a SC: Role of distribution in the SC, factors influencing distribution network design, Design options for distribution network, E-Business and the distribution network. **Transportation in a SC**: Role of Transportation in a SC, Modes of transportation and their performance characteristics, Design options for a transportation network, tailored transportation, Trade-offs in transportation design.	08 Hours
Module- 4	
Sourcing decisions in a SC: Role of sourcing in a SC, In-house and Outsource, supplier scoring & assessment, Supplier selection – Auctions and Negotiations, Contracts and Supply Chain performance. **Pricing and Revenue Management in a SC:** Role of Pricing and Revenue Management in a supply chain, Pricing and Revenue management for Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts.	08 Hours
Module- 5	
Information Technology in a SC: The role of IT in a Supply Chain, The Supply Chain IT framework,CRM, ISCM, SRM, Transaction Management Foundation (TMF), Future of IT in SC.The role of E-business in a supply chain with case studies. **Co-ordination in a SC:** Lack of SC Co-ordination and the Bullwhip effect, effect on performance of lack of co-ordination, Obstacles to Co-ordination in a SC. Managerial levers to achieve co-ordination, Building strategic partnerships and trust within a SC.	08 Hours
Course Outcomes: On completion of the course the student will be able to: 11. Know the basic concepts of SCM and list out the important drivers of SC. 12. Understand the importance of SC drivers and their influence on SC performance. 13. Apply the concepts of SCM on simple real time SC's.	
Question paper pattern: 13. The question paper will have ten questions. 14. Each full question consists of 16 marks. 15. There will be 2 full questions (with a maximum of 2-3 sub questions) in each module. 16. The students will have to answer 5 full questions, selecting one full question from each module.	

Text Books:

1. **Supply Chain Management** – Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; PearsonEducation Asia, ISBN: 9788120331587

Reference Books:

1. **Supply Chain Redesign** – Transforming Supply Chains into Integrated Value Systems - Robert B
Handfield, Ernest L Nichols - Jr., 2002, Pearson Education Inc, ISBN: 81-297-0113-8
3. **Modelling the Supply Chain** -Jeremy F Shapiro, Duxbury -Thomson Learning -2002, ISBN 0-534-37363.
4. **Designing & Managing the Supply Chain** -David Simchi Levi, Philip Kaminsky& Edith Simchi Levi -McGraw Hill.

ADVANCED MATERIALS & PROCESSING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	**16MPM154**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

Course Objective: The student will learn to

1. Understand metals and non metal structures. And various classes of advanced materials.
2. Identify various classes of composite materials, their properties and applications.
3. Distinguish various classes of shape memory alloys and the advantages of thin film Shape memory alloys for micro-electro mechanical systems (MEMS).
4. Know the application of composite materials in advanced engineering requirements.

Modules	Teaching Hours
Module- I	
Classification and Characteristics: Metals, Ceramics, Polymers and composites. **General Properties and Structure:** Atoms, molecules bonds in solids, Crystalline - Defects in Metallic structure, Dislocations and plastic deformation - Strengthening mechanism - grain size, dislocation - Cold work, precipitation hardening, dispersion hardening - phase reactions,	08 Hours
Module- 2	
Ferrous Alloys: iron carbon equilibrium diagrams - Steels and cast irons -properties, structure, composition and applications transformation hardening in steels - TIT diagrams. **Heat treatment processes** - Effect of alloying elements - High alloy steels, Stainless steel types, tool Steels, Manganese steels, heat resistant steels, HSLA.	08 Hours
Module- 3	

Polymers and polymerizations: Structure and properties of thermoplastics and thermo sets – Engineering Applications - property modifications - Mechanical and thermal behavior – processing methods. **Processing of Polymers:** composites, ceramics - thermal spraying - Ion beam machining diamond coating techniques..	08 Hours
Module- 4	
Composites : Definition - classification and characteristics of composite materials - Volume fraction – laminated composites particulate composites, fibrous composites - Types of reinforcements, their shape and size – production and properties of fiber reinforced plastics, Metal Matrix composites and ceramic matrix composites - Applications.	08 Hours
Module- 5	
Ceramics: Nature and structure of Ceramics - Refractory Abrasives glasses - glass ceramics - Advanced ceramics - processing methods. **Non Ferrous Alloys**: Alloys of copper, Aluminum, nickel, magnesium, titanium, lead, tin, Zinc - composition, heat treatment, structure, properties and application.	08 Hours

Course Outcomes:

On completion of the course the student will be able to :

1. Possess the skills and techniques necessary for modern materials engineering practice.
2. Understand and create the areas and domains in Materials & Metallurgical Engineering on the basis of interest and opportunity available in present industrial scenario.
3. Understand the basic principles of selection of materials and challenges to entrepreneurs in metallurgy
4. Gain the knowledge in advanced materials and their processing
5. Select appropriate advanced materials processes for a given product or component recognizing material, size, precision, and surface quality requirements.

Question paper pattern:

17. The question paper will have ten questions.
18. Each full question consists of 16 marks.
19. There will be 2 full questions (with a maximum of four sub questions) from each

module.

20. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. **Engineering Metallurgy** - Raymond and Higgens - ELBS/EA
2. **Introduction to Material Science and Engineering** - James.F.Shackleford - McMillan, NY - 7th edition.
3. **Powder Metallurgy-Metals Hand Book -**ASM, USA - Vol.7, 1974.

Reference Books:

4. **Composite Materials - Science and Engineering** - Chawla K.K. , Springer - Verlag, Newyork - 2nd edition,
5. **Smart Materials and Structures,** Chapman and Hall Gandhi, M.V., Thompson, B.S.,
6. **Advanced Materials,** Allied publishers Ray, A.K. (ed),

LAB COMPONENT - 1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	**16MPM16**	IA MARKS	20
Number of Lecture Hours/Week	03 (01 Instruction + 02 Practice)	Exam Marks	80
Total Number of Lab Hours	42	Exam Hours	03

Course Objective: The course objective is to make students to familiarize:

18. The basic procedures and concepts of programming, Work set up and operation of a CNC Machining Center.
19. Identification and understanding of basic programming codes.
20. Robot Programming methods.
21. Trajectory planning concepts of the Robotic Manipulator.

PART - A

Simulation of Turning, Drilling and Milling Operations using CAM Packages like CADEM, Master CAM, or any equivalent software.

1. Part Modeling, Machining and Simulation for Turning (Min. of 2 Exercises)
2. Part Programming and Simulation for Turning (Min. of 2 Exercises)
3. Part Modeling, Machining and Simulation for Milling (Min. of 4 Exercises)
4. Part Programming and Simulation for Milling (Min. of 2 Exercises)

PART - B

Robot Programming:

Design and Write a Robot program using Teach pendent and Offline programming to perform the following operations:

1. Pick and place operation (Min. of 2 Exercises)
2. Sorting Operation (Min. of 2 Exercises).
3. Automated Storage and Retrieval System (Min. of 2 Exercises).
4. Robotic Welding (Min. of 2 Exercises).

PART - C (Only for Demo)

1. Use of trajectory planning concepts on the model of a single-link robotic manipulator.
2. To familiarize students with the use of a vision system.

Course Outcomes:

After studying this course students will be able to:

6. Write the part programme to machine the component as per the part specification.
7. Gain knowledge about Robot programming.
8. Understand the trajectory planning concepts on a single-link robotic manipulator.
9. Get familiarized with the use of a Vision system.

Conduction of Practical Examination:

21. All laboratory experiments must be included for practical examination (Excluding Part-C).
22. Students are allowed to pick one experiment from each part and execute both.
23. PART - A: Procedure + Execution: 10 + 20 (30)
24. PART - B: Procedure + Execution: 10 + 20 (30)
25. Viva Voce (Part A + Part B + Part C): 20