COMPOSITE MATERIALS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Subject Code	**16MPM21**	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 concepts of modern composite materials and their applications.
2. Equip them with knowledge on how to fabricate and carry out standard mechanical test on composites.

Modules	Teaching Hours
Module- 1	
Introduction to composite materials: Definition, Classification, Types of matrices & reinforcements, characteristics & selection, Fiber composites, laminated composites, particulate composites, prepegs, sandwich construction. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance. Advantages and application of composites	10 Hours
Module- 2	
Micro mechanical analysis of a lamina: Introduction, Evaluation of the four elastic moduli – Rule of mixture, Numerical Problems. **Macro mechanics of a lamina:** Hooke's law for different types of materials, number of elastic constants, Laminate code,	10 Hours
Module- 3	
Manufacturing and Testing: Layup and curing - open and closed mould processing, Hand lay-up techniques, Bag moulding and filament winding. Pultrusion, Pulforming, Thermoforming, Injection moulding, Cutting, Machining, joining and repair. NDT test –Purpose, Types of defects, NDT method - Ultrasonic inspection, Radiography, Acoustic emission and Acoustic ultrasonic method.	10 Hours

Module- 4	
Fabrication of Composites: Cutting, machining, drilling, mechanical fasteners & adhesive bonding joining computer aided design manufacturing tooling fabrication equipment **Design of Fibre Reinforced Composite structures:** Introduction, Composite structural design, Design criteria, Laminate design, Mathematical analysis of the laminate, Design of composite stiffeners.forming dies, Dies for die casting and forging operations.	10 Hours
Module- 5	
Application developments – Aircrafts, missiles, space hardware, automobile, electrical and electronics, marine, recreational and sports equipment-future potential of composites. **Metal matrix composites:** Reinforcement materials, types, Characteristics & Selection, base metals-selection, applications. Powder metallurgy technique, liquid metallurgy technique	10 Hours

Course Outcomes:

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

1. Identify and explain the types of composite materials and their characteristic features
2. Understand the differences in the strengthening mechanism of composite and its corresponding effect on performance and application
3. Understand and explain the methods employed in composite fabrication
4. Appreciate the theoretical basis of the experimental techniques utilized for failure mode of composites

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. **Composite Materials Handbook** - Mein Schwartz - Mc Graw Hill Book Company - 1984.
2. **Mechanics of Composite Materials** - Autar K.Kaw - CRC Press New York - 1st edi, 1997.

Reference Books:

1. **Hand Book of Composite Materials** by Ed-Lubin
2. **Composite Materials** – K.K.Chawla
3. **Composite Materials Science and Applications** – Deborah D.L. Chung
4. **Composite Materials Design & Applications** – Danial Gay, Suong V. Hoa, & Stephen W. Tasi.

NON-TRADITIONAL MACHINING PROCESSES

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

SEMESTER – II

Subject Code	**16MPM22**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

Course Objective: The main objectives of this course are:

1. To provide the students with a proper understanding of NTM processes and difference between NTM and TM.
2. To expose the students with different types of NTM processes and their applications.
3. To expose the students with different types of high velocity forming process.

Modules	**Teaching Hours**
Module- I	
Introduction: Definition and need for NTM process, difference between NTM and TM, Classification of NTM, Process selection and comparative study of different processes. **Ultrasonic Machining (USM)** – Introduction, Mechanism of metal removal, elements of process, Tool feed mechanism, Effect of process parameter, Advantages, Disadvantages and Applications. **Abrasive Jet Machining (AJM)**: Introduction, working Principles, Effect of Process parameters /Variables, Advantages, Disadvantages and Applications.	08 Hours
Module- 2	
Electric Discharge Machining (EDM)- Introduction and mechanism of metal removal, types of EDM, basic EDM circuitry-spark erosion generators – Relaxation generator or R-C circuit, material removal rate in relaxation circuits, critical resistance, Electrical parameters in R-C Circuit, Die electric fluids, Flushing, Electrodes and its material selection, surface finish and machining accuracy, Advantages, Disadvantages and Applications. Electro Discharge Grinding (EDG) and Wire EDM.	10 Hours
Module- 3	
Electro Chemical Machining: Definition and working principal, Elements of ECM process, Chemistry of the ECM process, Process parameters, determination of the metal removal rate, Advantages, Disadvantages and Applications. Electro Chemical Grinding, Electro Chemical honing and Electro chemical deburring. **Chemical Machining**: Introduction and mechanism of metal removal, Elements of process – Maskants or Resists and Etchants, Advantages, Disadvantages and Applications.	10 Hours
Module- 4	
Plasma arc Machining: Introduction, Plasma, Generation of Plasma and equipment, Mechanism of metal removal, PAM parameters, type of torches, Safety precautions in PAM, applications. **Electron Beam Machining (EBM)**: Introduction and working principle of EBM, Equipment for production of Electron beam (Electron gun), Theory of electron beam machining - Thermal & Non thermal types, Advantages, Disadvantages and Applications.	10 Hours

Module- 5	
Laser Beam Machining (LBM): Introduction and working principle of LBM, generation of laser, Laser Equipment (Apparatus), Types of Lasers, Process characteristics, Advantages, Disadvantages and Applications **High Velocity Forming (HVF) process**: introduction, Advantages of HVF process, Types of high velocity forming methods - explosive forming, electromagnetic forming, and electro hydraulic forming.	12 Hours
Course Outcomes: On completion of this course the student is expected: 1. To know the basic concepts of NTM process and their difference over TM. 2. To be conversant with different types of NTM processes and their applications. 3. To be conversant with different types of HVF processes and their applications.	
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 2-3 sub questions) in each module. 4. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: **1. Modern Machining Process** - P.C Pandy & H.S. Shan - Tata McGraw Hill - ISBN: 0070965536 - Publishing Date: Feb-80.	
Reference Books: 1. **Production Technology** - HMT - Tata Mc Graw Hill - ISBN-10; 0070964432. 2. **High Velocity Forming of Metals** - F.M Wilson - ASTME Pretice Hall. 3. **Modern Manufacturing Method** - Adithan - New Age International (p) Limited - ISBN**:** 8122408176, 2007. 4. **Modern Machining Processes** - P.K. Mishra - Narosa Publishing House, New Delhi - 1997.	

OPERATIONS MANAGEMENT

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

SEMESTER – II

Subject Code	**16MPM23**	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 concepts of Production and Operations function, role of Operations Strategy

2.Familiarize the factors affecting plant location, site selection and space requirements and To understand the types of layouts, tools and techniques for developing layouts

3 Understand the need of Forecasting and their methods and personnel Management.

4. Familiarize the SCM and Environmental Considerations in Production and Operations Management.

5 Impart knowledge on various Scheduling techniques.

Modules	Teaching Hours
Module- 1	
Introduction to Production and Operation management: Operations Management – Need, History, System, functions. Environment of operations, Concept of productivity and its analysis, Computing productivity (Numericals) **Operations Strategy**: Strategic management process, Operations/ manufacturing Strategy meaningful differentiation, Flexibility, Comparison: Traditional vs New approaches, cost leadership, Operations Strategies, Key success factors, Strengths, Weakness, Opportunities and Threats (SWOT) analysis, Five forces model, Operations Strategic action and its relationship with other, Functional areas of management, Operation Function's role: a new concept, Globalization	10 Hours
Module- 2	

Facility Location: Nature of location decision, situations that influence location decision, Case of the already established organization, location choice for the first time, Choice of a site within a region, Backward areas and industrial policy, Global location, Reasons for a foreign location, Location of facilities for service businesses, Behavioural aspects in location panning of services, Location models – Factor rating method, Weighted factor rating method, Load-distance method, Centre of gravity method, Break-even analysis. Locational economics (Numericals) **Plant Layout:** Features, Cost, Optimization in a product/line layout, Optimization in process Layout, Assembly line balancing: Line efficiency, balance delay (Numericals)	10 Hours
Module- 3	
Forecasting: Need and importance of Forecasting, Input-Output of forecasting Model, Techniques: Delphi Method, Simple and Moving average, Exponential Smoothing, Correlation and Regression Analysis, Karl Pearson's Correlation, Minimizing forecasting errors - MAD, Tracking Signal. **Personnel management in Operations Management:** Personnel policy, Employment and manpower planning, Education Training and management development, Industrial relations, Health, safety and welfare.	10 Hours
Module- 4	
Purchasing and Supply Chain Management (SCM): Introduction, Importance of purchasing and SCM, The procurement process, Concept of tenders, Approaches to SCM, Vendor development, Measures of purchasing and SCM, Make or buy decision, Types of buying, E-procurement. **Environmental Considerations in Production and Operations Management :** productions and service operations disturb the environment, making the processes 'Green' , similarities in Operations and Environment issues, , Organizational response to environmental sustainability.	10 Hours
Module- 5	
Scheduling: Priority decision rules, Johnson's Algorithm for job sequencing (n job through 2 machines, n jobs through 3 machines, n jobs through m machines and 2 jobs through m machines) Use of Gantt charts. (Numericals) **Role of Operations Management:** Role of production and Operations Management in Flexible manufacturing system (FMS), Robotics, Computer integrated manufacturing (CIM), Service orientation and customer focus.	10 Hours

TOTAL QUALITY MANAGEMENT

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

SEMESTER – II

Course Outcomes:

On completion of the course the student will be able to

1. Analyze the various factors of Production & Operations Management System and will be able to identify Operations Strategy of any firm
2. Analyze the various factors involved in deciding the facility, layout for a firm & analyze the evaluation and implementation of layouts.
3. Familiar with forecasting types and personnel management.
4. Understand the Purchasing and Supply Chain Management and Environmental Considerations in Production and Operations Management
5. Get awareness of different scheduling techniques and role of OM in different 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:

Production and operations management-S N Chary 4th edition –Tata-Mcgraw hill New Delhi second print 2009

Production and operations management-Alan-muhlemann, Johnoakland, Keith lockyer.6th Edition, 1992 ELBS Pitmen publishing , London

Reference Books:

1 **Modern Production / Operations Management** by E.S. Buffa , 5th Ed, John Wiley & Sons.

2 **Production / Operations Management** by Joseph G Monks, Mc Graw Hill Books

3**. Operations Management for Competitive Advantage**, R.B.Chase, N.J.Aquilino, F. Roberts Jacob; McGraw Hill Companies Inc., Ninth Edition.

4. **Supply Chain Management** by Chopra and Meindl, Pearson Education, 3rd Ed.,. 2007.

Subject Code	**16MPM24**	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 philosophy and core values of Total Quality Management (TQM).
2. Determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization.
3. Apply and evaluate best practices for the attainment of total quality.

Modules	Teaching Hours
Module- 1	
PRINCIPLES AND PRACTICE: Definition of TQM , basic approach, Obstacles to TQM, TQM Framework, benefits of TQM **BUSINESS EVOLUTION:** Customer Satisfaction, four fitness of Customer Satisfaction, Evolution of Customer Satisfaction Methodology, Leadership vs Empowerment, Four Practical Revolutions in Management thinking , Four Levels of Practice.	08 Hours
Module- 2	
CUSTOMER FOCUS: Change in the Work Concept: Market-in, Philosophy-in and Philosophy-out, Evolution of Customer Focus and Its Challenges, Three Stages of Customer Focus, Customer Concerns, Integration of Concerns, Individualizing Customers	08 Hours
Module- 3	
CONTINUOUS IMPROVEMENT: Management by process, WV Model of Continuous Improvement, Three types of improvements, Continuous Improvement of Processes for All Types of Work, Continuous Improvement verses breakthrough, Continuous Improvement and the Scientific Method.	10 Hours
Module- 4	

MANAGING EXISTING PROCESSES: Process Discovery and Management: Thinking In Terms of Process, Process Discovery, steps of Process Discovery, benefits of Process Discovery, process control and process improvement, The 7 QC Tools. **PROACTIVE IMPROVEMENT**: Proactive Improvement concept, Kawakita's Five Principles, Language Data and Use of Semantics, Comparison of Affective and Report language, Five principles of Customer Visitation, The purpose of Proactive Improvement to Develop New Products, Transforming voice of customer into customer requirements.	12 Hours
Module- 5	
TOTAL PARTICIPATION: Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, three sets of skills of leader ship ,Team work Skill , Some Fundamentals , Some Types of Teams .QC Circles. **INITITATION STRAGIES AND** MOBILIZATION : CEO involvement and the importance of CEO, A General Model for Mobilization, Hoshin Management, Hoshin Management and Its Parts, Proactive , Reactive, and Control phases in Management	12 Hours

Course Outcomes:

On completion of the course the student will be able to

1. Learn the principles and practices of TQM.
2. Know the evolution and challenges made in industries by TQM.
3. Understand the models to solve the problems and improving the circumstances.
4. Learn the quality tools implemented in industries and its performances.
5. Know the involvement of employees and the changes by management.

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. **"Four Practical Revolutions in Management: systems for creating unique organizational capability"** -Shoji Shiba and David Walden,– Productivity Press & Center for Quality Management, (USA) , 2001, Special Indian Edition,ISBN-9781563273889/9781563272172/ 9781563272318
2. **"Total Quality Management"**- *Besterfield*, Pearson Education, 2011. ISBN, 817758412X, 9788177584127

Reference Books:

1. **"Management for Total Quality"** -N Logothetis- Prentice Hall of India, New Delhi, 2003, ISBN-81-203-1137-X
2. **"Total Quality Management"**-H D Ramachandra and K R Phanesh-2006 edition.

LAB COMPONENT- II

[As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Subject Code	**16MPM26**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lab Hours	42	Exam Hours	03

List of Experiments	
1	Determination of Chip reduction co-efficient (reciprocal of chip thickness ratio) during single point turning.
2	Forces measurements during orthogonal turning
3	Estimation of Power required during orthogonal turning
4	Torque and Thrust measurement during drilling
5	Roughness determination for machined surfaces and its influence of tool geometry and feed rate.
6	Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing
7	Study the principle & construction of the Metallurgical Microscope and prepare metallic samples for metallographic examination
8	Study of Microstructure and Hardening of steel in different medium and cooling rates
9	Effect of Carbon percentage on the hardness of Steel.
10	Determination of wear and coefficient of friction for the given specimen using pin on disc tester
11	Study and use of Magnetic crack detector.
12	Study of Impact test on Steel by using Izod & Charpy test.

NON - DESTRUCTIVE TESTING [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Subject Code	**16MPM251**	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 the role of testing and importance of non destructive testing.
2. Have consequential approach for the selection of nondestructive testing methods.
3. Know Procedures to be followed in nondestructive testing, precautions and limitations.

Modules	Teaching Hours
Module- 1	
MAGNETIC PARTICLE INSPECTION: Methods of generating magnetic field, types of magnetic particles and suspension liquids steps in inspection – application and limitations	06 Hours
Module- 2	
EDDY CURRENT INSPECTION: principles, operation variables, procedure, inspection coils, and detectable discounts by the method. **MICROWAVE INSPECTION:** Microwave holography, applications and limitations.	08 Hours
Module- 3	
ULTRASONIC INSPECTION: Basic equipment characteristics of ultrasonic waves, variables inspection, inspection methods pulse echo A,B,C scans transmission, resonance techniques, transducer elements couplets, search units, contact types and immersion types inspection standards-standard reference blocks	10 Hours
Module- 4	
RADIOGRAPHY INSPECTION: Principles, radiation source X-rays and gamma rays, X-ray tube, radiographic films, neutron radiography, Thermal inspection principles, equipment inspection methods applications.	08 Hours
Module- 5	
OPTICAL HOLOGRAPHY: Basics of Holography, recording and reconstruction Acoustical Holography: systems and techniques applications. Indian standards for NDT.	08 Hours

Course Outcomes:

On completion of the course the student will able to:

1. Handle the NDT equipments.

2. Understand the defect pattern & defect assessment.
3. Record and to present the defects after non destructive testing
4. Select the alternative methods for accessible defects and also exact defect location.

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.

Reference Books:

1. Non Destructive Testing Mc Gonnagle JJ – Garden and reach New York.
2. Non Destructive Evolution and Quality Control volume 17 of metals hand book 9 edition Asia internal 1989.
3. The Testing instruction of Engineering materials Davis H.E Troxel G.E wiskovil C.T McGraw hill.

SURFACE TREATMENT AND FINISHING

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

SEMESTER – II

Subject Code	**16MPM252**	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	
Fundamentals of Electro plating: Galvanizing, Hot dip metal coating, thin coating, thin coating, chromium plating, Nickel plating.	08Hours
Module- 2	
Vacuum coating, FVD & CVD metal spraying - Methods, surface preparation, mechanical **Properties of sprayed metals, plasma coating.**	08 Hours
Module- 3	
Plastic coating of metal - PVC coating Spherodising process details, phosphate coating - mechanism of formation.	08 Hours
Module- 4	
Heat treatment methods, Annealing, Normalizing, Tempering, Case hardening methods, flame hardening sub zero treatment.	08 Hours
Module- 5	
Heat treatment methods for gears, spindles, cutting tools. **Advanced coating technologies:** Hard facing, electro deposition technique, coating characterization.	08Hours

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.

REFERENCE BOOKS:

1. **Surface preparations & finishes for Metals** - James A Murphy - McGraw Hill.
2. **Principles of metal surface treatment and protection** - Pergamon Press Gabe, David Russell - Description, Oxford ; New York - 2d ed., 1978
3. **Handbook of metal treatment and testing** - John wiley & sons.
4. **Heat Treatment of Metals –** Zakrov - MlR Publications.
5. **Metal Hand Book** –ASM.

.

ADVANCED FOUNDRY TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Subject Code	**16MPM253**	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

4. Solidification process, Gates and Risers
5. Concepts of casting design and casting defects
6. Understand constructional features and working of different foundry furnaces
7. Understand Ferrous and Aluminum metals and alloys.
8. Foundry Mechanization and Modernization.

Modules	Teaching Hours
Module- 1	
SOLIDIFICATION OF CASTING: Concept of solidification of metals. Homogenous and heterogeneous nucleation. Growth mechanism. Solidification of pure metals and alloys. Mechanism of columnar and dendritic growth. Coring or Segregation. Concept of progressive and directional solidifications. **PRINCIPLES OF CASTING AND RISERING**: Design of the gating System. Different types of gates. Gating ratio and its functions. Definition and functions of the riser. Types of risers and their application. Design of the riser - its shape. Size and location.	08 Hours
Module- 2	
DESIGN OF CASTING: Factors to be considered in casting design. Design consideration in pattern making, moulding techniques and core making and assembly. Cooling stresses and hot spots in casting and modification in casting geometry to overcome them. **CASTING QUALITY CONTROL**: Casting defects and factors responsible for them. Different inspection and testing methods to evaluate the casting. Quality control activities in a foundry. Salvaging methods of defective casting.	08 Hours
Module- 3	

FURNACE TECHNOLOGY: Melting furnace design, Heat sources, developments, melting conditions, losses, special melt treatments, melt temperature. Pouring equipments and techniques, special pouring techniques, Ladle heating and insulation. Study of various furnaces used in foundry, construction and operation of crucible and hearth furnaces. Resistance, Arc and Induction furnaces-their construction. Operation and application.	08 Hours
Module- 4	
STEEL CASTING PRACTICE: Common steel casting, their composition, structure and properties. Melting and refining of steel. Gating and risering of steel castings cleaning of steel castings. **ALUMINIUM FOUNDRY PRACTICE:** Composition, properties and application of common aluminum alloy casting. Melting and casting of AI-alloys. Gating and risering of AI-alloy casting.	08 Hours
Module- 5	
FOUNDRY MECHANIZATION AND MODERNIZATION: Introduction to modernization. Mechanization of foundry and its advantages. Mechanization of sand plant, moulding and core making mechanization in melting, pouring and shakeout units. Material handling equipments and conveyor systems. Captive and mechanized foundries.	08 Hours

Course Outcomes:

On completion of the course the student will be able to

4. Understand the Solidification process, Gates and Risers types and design
5. Design simple casting design and learn casting defects
6. Understand constructional features and working of different foundry furnaces
7. Understand Ferrous and Aluminum metals and alloys
5. Understand Foundry Mechanization and Modernization

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 four sub questions) from each module.
16. The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **Principle of metal casting** - Heine, et. al - Tata-McGraw-Hill Publication - 2003.

2. **A test book of FoundryTechnology** - Lal, M. Khanna, P.O - DhanpatRai & Sons Publication.

3. **Foundry Technology** – Peeter Beelely, – Butterworth.

SIMULATION AND MODELING OF MANUFACTURING SYSTEMS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – II

Subject Code	**16MPM 254**	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. Define the basics of simulation modeling and replicating the practical situations in organizations
2. Generate random numbers and random variants using different techniques.
3. Develop simulation model using heuristic methods.
4. Analyze s of Simulation models using input analyzer, and output analyzer.
5. Explain Verification and Validation of simulation model.

Modules	Teaching Hours
Module- 1	
Principle of Computer Modelling and Simulation: Monte Carlo simulation. Nature of computer- modelling and simulation. Limitations of simulation, areas of applications. **System and Environment:** Components of a system -discrete and continuous systems, Models of a system -a variety of modelling approaches.	08 Hours
Module- 2	
Discrete Event Simulation: Concepts in discrete event simulation, manual simulation using event scheduling, single channel queue, too server queue, simulation of inventory problem. **Statistical Models in Simulation:** Discrete distributions, continuous distributions.	08 Hours
Module- 3	
Random Number Generation: Techniques for generating random numbers- Mid square method -the mod product method -Constant multiplier technique -Additive congruential method –Linear congruential method -Tests for random numbers -The Kolmogorov-Smimov test -the Chi-square test. Ivica Cmkovic, Ulfaskluna and Annita borsen Dohlgvist Publisher Artechhouse.	08 Hours
Module- 4	
Random Variable Generation: Inversion transforms technique-exponential distribution. Uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution. **Empirical Discrete Distribution:** Discrete uniform - distribution poisson distribution -geometric distribution - acceptance - rejection technique for Poisson distribution gamma distribution.	08 Hours
Module- 5	
Design and Evaluation of Simulation Experiments: variance reduction techniques -antithetic variables, variables verification and validation of simulation models. **Simulation Software:** Selection of simulation software, simulation packages.	08 Hours

Course Outcomes:

After successful completion of the course, the students will be able to:

1. Describe the role of important elements of discrete event simulation and modeling paradigm.
2. Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
3. Develop skills to apply simulation software to construct and execute goal-driven system models.
4. Interpret the model and apply the results to resolve critical issues in a real world environment.

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. **Discrete Event System Simulation** - Jerry Banks & .John S Carson II - Prentice Hall Inc.-1984.
2. **Systems Simulation** - Gordan. G. - Prentice Hall India Ltd - 1991.

Reference Books:

1. **System Simulation with Digital Computer** - Nusing Deo - Prentice Hall of India - 1979.
2. **Computer Simulation and Modeling** - Francis Neelamkovil - John Wilely & Sons - 1987.
3. **Simulation Modeling with Pascal** - Rath M.Davis & Robert M O Keefe - Prentice Hall Inc. - 1989.