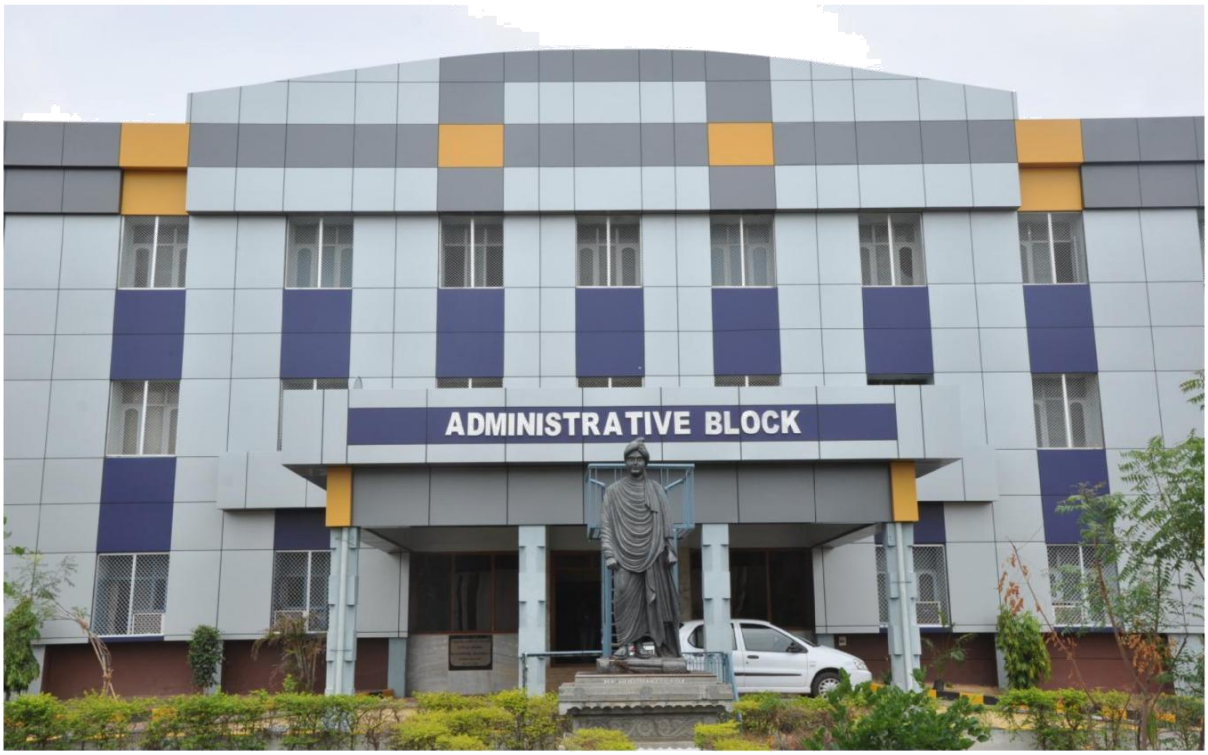

Scheme – 2025

Department of Mechanical Engineering

G. Pulla Reddy Engineering College (Autonomous): Kurnool

Accredited by NBA of AICTE and NAAC of UGC

Affiliated to JNTUA, Anantapuramu

Scheme and Syllabus for

M. Tech in Advanced Manufacturing Technology

(With Effect from the Batch Admitted in 2025-26)

G. PULLA REDDY ENGINEERING COLLEGE (AUTONOMOUS): KURNOOL
DEPARTMENT OF MECHANICAL ENGINEERING
Two Year M.Tech Degree Program
ADVANCED MANUFACTURING TECHNOLOGY (AMT)

SCHEME OF INSTRUCTION AND EXAMINATION
(Effective from 2025-26)

M.Tech I SEMESTER **Scheme-2025**

S. No	Category	Course Title	L	T	P	Credits	End Exam marks	CIA Marks	Total
1	PC	Advanced Production Technology	3	0	0	3	60	40	100
2	PC	Advanced Finite Element Analysis	3	0	0	3	60	40	100
3	PE	Professional Elective-I	3	0	0	3	60	40	100
4	PE	Professional Elective-II	3	0	0	3	60	40	100
5	PC	Computer Aided Engineering Lab	0	0	4	2	60	40	100
6	PC	Material Testing Lab	0	0	4	2	60	40	100
7	MC	Research Methodology & IPR	2	0	0	2	60	40	100
8	SE	Artificial Intelligence & Machine Learning	2	0	0	2	60	40	100
9	AC	Audit Course-I	2	0	0	0			
		Total	18	0	8	20	480	320	800

List of Professional Elective Courses

Description	Subject Title
PE-I	1. Optimization Techniques
	2. Computer Aided Process Planning
	3. Composite Materials
PE-II	1. Advanced Materials Engineering
	2. Design of Advanced Hydraulic and Pneumatic Systems
	3. Design for Manufacturing and Assembly

List of Audit Course

AC-I	1. English for Research Paper Writing
	2. Disaster Management
	3. Essentials of Indian Traditional Knowledge

ADVANCED PRODUCTION TECHNOLOGY (APT)

I Semester : AMT					Scheme : 2025			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
	PC	L	T/D	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the fundamentals of metal casting and evaluate, compare, and select suitable casting processes considering defects, design, economics, and foundry practices.

CO2: Apply the principles of welding and solid-state joining processes, and evaluate weld quality, weldability, and suitable joining methods based on design, testing, and application requirements.

CO3: Apply and evaluate advanced metal forming processes, including hot and cold deformation and high energy rate forming methods.

CO4: Analyse advanced machining processes, including EDM, ECM, LBM, EBM, PAM, USM, AJM, and micromachining and nanofabrication applications.

CO5: Evaluate the production, compaction, sintering, and shaping processes of ceramics, glass, and superconducting materials considering design requirements.

UNIT – I

Metal Casting: Introduction – solidification of metals – fluid flow – fluidity of molten metal Heat transfer – defects – design considerations – Economics of casting – foundry and foundry automation.

Metal Casting Processes: Sand casting shell moulding – expandable pattern casting – plaster mould and ceramic mould castings – investment casting – vacuum casting – permanent mould casting – slush casting – squeeze casting and semi solid metal forming.

UNIT – II

Welding Processes: Oxy-fuel gas welding arc welding – thermit welding – electron beam welding – laser beam welding – weld quality – weld ability – testing – weld design and process selection.

Solid State Welding Processes: cold welding – ultrasonic welding – friction welding. Resistance welding – explosion welding – diffusion welding – super-plastic forming – adhesive joining – joining plastics, thermal spraying.

UNIT – III

Advanced Metal Forming : Hot and cold deformation processes, high energy rate forming, Explosive forming, hydraulic forming etc.

UNIT – IV

Advanced Machining Processes: Electro Discharge Machining (EDM), Electro Chemical Machining (ECM), Laser Beam Machining (LBM), Electron Beam Machining (EBM), Plasma Arc Machining (PAM), Ultrasonic Machining (USM), Abrasive Jet Machining (AJM) – nanofabrication – micromachining applications.

UNIT – V

Ceramics and Super Conductors: Production, compaction, sintering of powders – design considerations – shaping of ceramics – forming and shaping of glass – processing of super conductors.

Text Books :

1. Richard W Heine – Principles of Metal Casting, Tata Mcgraw Hill Education Private Limited.
2. Dr R.S.Parmer – Welding Processes and Technology, Khanna Publishers.
3. Surender Kuma – Technology of Metal Forming Processes, Prentice- Hall,
4. Manufacturing Science – A.Ghosh & A.K. Mallik, EWP.

Reference Books :

1. T.R.Vijayaram – Advanced Casting Technology, IntechOpen Publishrs.
2. John Norris - Advanced Welding Processes Technologies and Process Control, WoodHead Publishing Ltd.
3. Isaac Chang and Yuyuan Zhao – Advances in Powder Metallurgy, Properties, Processing and Applications, Wood Head Publishing.

Question Paper Pattern:

1. Sessional Examination: The question paper for internal examination shall be for **30** Marks. The question paper shall contain **Three** questions and the student has to answer **Three** questions (**without choice**). Each Question carries **10** marks..

2. End Examination: The question paper for End examination shall be for **60** marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries **12** marks.

ADVANCED FINITE ELEMENT ANALYSIS (AFEA)

I Semester : AMT					Scheme : 2025			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
	PC	L	T/D	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

Course Outcomes : At the end of the course the student will be able to

CO1: Solve boundary value problems using classical as well as finite element methods.

CO2: Solve problems related one dimensional solid mechanics and heat transfer.

CO3: Solve problems related to two dimensional and axi-symmetric elements.

CO4: Understand various manufacturing processes with the application of finite element techniques.

CO5: Solve simple practical problems using commercial FE analysis packages.

UNIT – I

Introduction – Basic of FEM – Initial value and boundary value problems – weighted residual Galerkin and Raleigh – Ritz methods – simple problems – Basics of variational formulation – Polynomial and Nodal approximation.

UNIT – II

One Dimensional Analysis: Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT – III

Two Dimensional Analysis: Shape functions and higher order formulations – Global and Natural co-ordinates – Shape functions for one and two dimensional elements- three noded triangular and four noded quadrilateral element – Jacobian matrices and transformations – basic of two dimensional axi-symmetric analysis**.**

UNIT – IV

Analysis of Production Processes: Analysis of production processes – FEA of metal casting-Special considerations, Basic concepts of plasticity – Solid and flow formulation – Small incremental deformation formulation – FEA of metal cutting, chip seperation criteria, incorporation of strain rate dependency – FE analysis of welding.

UNIT – V

Computer Implementation in FEA: Computer implementation – Pre-processing, Mesh-generation, element connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – ANSYS – Development of code for one dimensional analysis and validation.

Text Books :

1. Reddy, J.N. An Introduction to the Finite Element Method, Mc Graw Hill, 1985.
2. Rao, S.S., Finite Element method in engineering, Pergamm onpress, 1989.
3. Bathe, K.J., Finite Element procedures in Engineering Analysis, 1990.

Reference Books :

1. Kobayashi, S,Soo-ik-Oh and Altan, T,Metal Forming and the Finite Element Methods, Oxford University Press, 1989.
2. Lewis R.W.Morgan, K,Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, JohnWiley, 1994.
3. Lars-Erik Lindgren., "Computational Weld Mechanics – Thermomechanical and microstructural simulations", Woodhead Publishing Ltd., Cambridge England, 2007.
4. P Seshu, "Textbook of Finite Element Analysis", PHI Learning Private Limited , 2003

Question Paper Pattern:

1. Sessional Examination: The question paper for internal examination shall be for **30** Marks. The question paper shall contain **Three** questions and the student has to answer **Three** questions (**without choice**). Each Question carries **10** marks..

2. End Examination: The question paper for End examination shall be for **60** marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries **12** marks.

COMPUTER AIDED ENGINEERING LAB (CAEP)								
I Semester : AMT					**Scheme : 2025**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	PCL	**L**	**T/D**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		-	**-**	**3**	**2**	**40**	**60**	**100**
Sessional Exam Duration : 3 Hrs					**End Exam Duration: 3 Hrs**			
Course Outcomes : At the end of the course the student will be able to								
CO1: Understand basic features of ANSYS.								
CO2: Analyze the deformation and stresses in beams, trusses and plate using ANSYS.								
CO3: Analyze heat transfer on plates using ANSYS.								
LIST OF EXPERIMENTS								
1. Truss analysis using FEA software.								
2. Beam analysis using FEA software.								
3. Buckling analysis of columns using FEA software.								
4. Harmonic analysis using FEA software.								
5. Fracture analysis using FEA software.								
6. Analysis of laminated composites using FEA software.								
7. Couple - field analysis using FEA software.								
8. Transient dynamic analysis.								
9. Modal analysis to obtain natural frequencies.								
10. Elasto - Plastic analysis.								

MATERIAL TESTING LAB (MTP)								
I Semester : AMT					**Scheme : 2025**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	PCL	**L**	**T/D**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		-	**-**	**3**	**2**	**40**	**60**	**100**
Sessional Exam Duration : 3 Hrs					**End Exam Duration: 3 Hrs**			
Course Outcomes : At the end of the course the student will be able to								
CO1: Understand the Preparation of specimen for Wear Testing.								
CO2: Evaluate the hardness and Impact strength of different materials.								
CO3: Evaluate the Tensile, Compression and Flexural strength of Composite material.								
CO4: Evaluate the wear rate Under various Loads.								
CO5: Understand the wear rate by varying Time.								
LIST OF EXPERIMENTS								
1. Preparation of Specimen to ASTM standards for Wear testing.								
2. Hardness Test: Estimating the Hardness of different Engineering materials using Rockwell Hardness Tester.								
3. Impact Test: Determining the impact strength of a given material using IZOD impact testing Machine.								
4. Tension Tests using Universal Testing Machine: Tension test on the given specimens (at least 2 materials for comparison) and to plot the stress strain graphs.								
5. Compression Tests using Universal Testing Machine: Compression test on the given specimen and to plot the stress strain graphs.								
6. Flexural Test using Universal Testing Machine: Bending test, on the given specimens and to plot the stress strain graphs								
7. Wear test using Du-Con wear Testing Machine: Dry Wear test, on the given specimen and to plot the Wear rate verses Load graphs time constant.								
8. Wear test using Du-Con wear Testing Machine: Dry Wear test, on the given specimen and to plot the Wear rate verses Time graphs Load constant.								
9. Wear test using Du-Con wear Testing Machine: Wear test with Lubrication, on the given specimen and to plot the Wear rate verses Load graphs time constant.								
10. Wear test using Du-Con wear Testing Machine: Dry Wear test on the given specimens and to Determine Wear rate with varying disc speeds.								

RESEARCH METHODOLOGY AND IPR (RM & IPR)								
I Semester : AMT					**Scheme : 2025**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	PC	**L**	**T/D**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		2	**-**	**-**	**2**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the Meaning, types of research, research problems and research design.

CO2: To know the basic data collection methods and sampling design.

CO3: Know the basic concepts intellectual property rights and patent design

CO4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT – I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, scope, and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT – II

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT – III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications

UNIT – V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books :

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

Reference Books :

1. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd , 2007.
3. Mayall, “Industrial Design”, McGraw Hill, 1992.
4. Niebel, “Product Design”, McGraw Hill, 1974.

Question Paper Pattern:

1. Sessional Examination: The question paper for internal examination shall be for **30** Marks. The question paper shall contain **Three** questions and the student has to answer **Three** questions (**without choice**). Each Question carries **10** marks.

2. End Examination: The question paper for End examination shall be for **60** marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries **12** marks.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AIML)

I Semester : AMT					Scheme : 2025			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T/D**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
	SE	**2**	**-**	**-**	**2**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand AI basics, its impacts, and intelligent agent behavior in environments.

CO2: Examine problem-solving approaches and apply uninformed search strategies to various tasks.

CO3: Apply informed search strategies using heuristic functions for efficient problem-solving.

CO4: Implement basic machine learning concepts and build simple linear regression models for predictive analysis.

CO5: Apply classification techniques using logistic regression, decision trees, and K-NN for predictive modelling.

UNIT – I

Introduction to AI: What Is AI?, Risk and benefits of AI.
Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments and the Structure of Agents.

UNIT – II

Solving Problems by Searching: Problem-Solving Agents, Example Problems, Searching for Solutions.
Uninformed Search Strategies: BFS, DFS, Depth –limited search, IDA, Bidirectional search.

UNIT – III

Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Memory-bounded heuristic search, learning to search better. Heuristic Functions.

UNIT – IV

Introduction To Machine Learning: Introduction to Analytics and Machine Learning, Why Machine Learning? Framework for Developing Machine Learning Models.
Linear Regression: Simple Linear Regression, Steps in Building a Regression Model, Building Simple Linear Regression Model.

UNIT – V

Classification Problems: Classification Overview, Binary Logistic Regression, Credit Classification, Gain Chart and Lift Chart, Decision Tree Classification, K-Nearest Neighbour Classifier.

Text Books:

1. Russell Stuart and Peter Norvig, Artificial intelligence: a modern approach, Pearson, New Delhi.
2. Manaranjan Pradhan and U Dinesh Kumar, Machine Learning using Python, Wiley, New Delhi.

Reference Books:

1. Andreas C Muller and Sarah Guido, Introduction to Machine learning with python, O'Reilly, CA.
2. Saroj Kaushik, Artificial Intelligence, Cengage Learning India, Noida.
3. Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill, New Delhi.
4. Ethem Alpaydin, Introduction to Machine Learning, The MIT Press, Cambridge.

Online Resources:

1. https://nptel.ac.in/courses/113104517
2. https://nptel.ac.in/courses/127104664
3. https://nptel.ac.in/courses/110104164
4. https://nptel.ac.in/courses/106106226

Question Paper Pattern:

1. Sessional Examination: The question paper for internal examination shall be for **30** Marks. The question paper shall contain **Three** questions and the student has to answer **Three** questions (**without choice**). Each Question carries **10** marks.
2. End Examination: The question paper for End examination shall be for **60** marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries **12** marks.

Professional Elective – I

OPTIMIZATION TECHNIQUES (OT)								
I Semester : AMT PE-I					**Scheme : 2025**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	PE	**L**	**T/D**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the concepts of Optimization, Linear programming, Integer programming.

CO2: Apply the classical optimization techniques to multi variable optimization

CO3: Understand and apply the Dynamic programming to specific applications.

CO4: Understand the concepts of Genetic algorithms and its operators

CO5: Understand and apply the Evolutionary Algorithms.

UNIT – I

Introduction to Engineering Applications of Optimization, Classification of Optimization problems.
Linear Programming: Simplex method, Big-M method, Duality
Integer Programming: Simple applications of integer programming, solution methods of integer programming – Branch and Bound Algorithm, Cutting Plane Algorithm for all integers only

UNIT – II

Classical Optimization Techniques: Single variable optimization with and without constraints, multi – variable optimization with and without constraints, methods of Lagrange multipliers, Kuhn-Tucker conditions

UNIT – III

Dynamic Programming: Elements of dynamic programming model, Back ward recursive equation, Applications of Dynamic Programming to Linear programming and Capital budgeting.

UNIT – IV

Genetic Algorithm: Introduction, Difference between Genetic Algorithm and Traditional Methods, Simple Genetic Algorithms, Similarity Templates (Schemata), Genetic algorithm operators –selection, crossover and mutation. Simple applications of GA.

UNIT – V

Evolutionary Algorithms: Ant Colony Optimization, Tabu Search and Particle Swam optimization algorithms.

Text Books :

1. S.S. Rao – Engineering Optimization Theory and Practice,John Wiley& Sons.
2. S.D. Sarma, –Operations Research, Kedarnath Publishers.
3. David E. Goldberg – Genetic Algorithms, Pearson Education India.

Reference Books :

1. Hamdy A.Taha, — Operations Research: An Introduction, Pearson Publications.
2. Kalyanmoy Deb — Optimization for Engineering Design :Algorithms and examples, Prentice Hall, India

Question Paper Pattern:

1. Sessional Examination: The question paper for internal examination shall be for **30** Marks. The question paper shall contain **Three** questions and the student has to answer **Three** questions (**without choice**). Each Question carries **10** marks.
2. End Examination: The question paper for End examination shall be for **60** marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries **12** marks.

COMPUTER AIDED PROCESS PLANNING (CAPP)

I Semester : AMT PE-I					Scheme : 2025			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	PE	**L**	**T/D**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course the student will be able to

CO1: Evaluate the definition, scope, information requirements, and the role of process planning in CAD/CAM systems**.**

CO2: Evaluate computer-aided process planning (CAPP), its advantages over conventional process planning, the structure of automated process planning systems, and feature recognition methods.

CO3: Explain the types of process planning including manual, variant (retrieval), generative approaches, and automated systems such as CAM-I CAPP, DCLASS, and CMPP**.**

CO4: Analyze alternative manufacturing processes, their significance, and apply quantitative methods for optimal process selection and setup cost reduction.

CO5: Explain CAPP implementation techniques, selection criteria, benefits, and the role of computer integrated planning and capacity planning system

UNIT – I

Introduction: Definition, Scope of Process planning, Information requirement for process planning system, Role of process planning in CAD/CAM

UNIT – II

CAPP: Computer aided Process planning, advantages of CAPP over conventional process planning, Structure of Automated process planning system, feature recognition, methods.

UNIT – III

Types Process Planning: Manual approach, Variant or Retrieval approach and Generative approach, CAM-I automated process planning (CAPP), DCLASS, CMPP

UNIT – IV

Alternative Manufacturing Processes: Significance, alternative manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples.

UNIT – V

Implementation Techniques for CAPP: Criteria for selecting a CAPP system and benefits of CAPP. Computer integrated planning systems, and Capacity planning system.

Text Books :

1. Mikell Groover- Automation, production systems and computer integrated manufacturing, Pearson Publishers.
2. Tien-Chien Chang, Richard A. Wysk, An Introduction to automate process planning systems, Prentice Hall International series.

Reference Books :

1. David D.Bed worth, Mark R. Henderson, Philip M. Wolfe – Computer aided design and manufacturing, Mc GrawHill Publishers.
2. P.N. Rao, N.K. Tiwari, T.N. Kundra- Computer Aided Manufacturing, McGraw Hill Education.

Question Paper Pattern:

1. Sessional Examination: The question paper for internal examination shall be for **30** Marks. The question paper shall contain **Three** questions and the student has to answer **Three** questions (**without choice**). Each Question carries **10** marks.

2. End Examination: The question paper for End examination shall be for **60** marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries **12** marks.

COMPOSITE MATERIALS (CM)

I Semester : AMT PE-I					Scheme : 2025			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
	PE	L	T/D	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

Course Outcomes : At the end of the course the student will be able to

CO1: Explain the advantages and applications of composite materials

CO2: Describe the properties of various reinforcements of composite materials.

CO3: Describe the manufacture of polymer matrix composites

CO4: Summarize the manufacture of metal matrix, ceramic matrix and C-C composites.

CO5: Describe the various joining methods of composite materials.

UNIT – I

Introduction: Definition – Classification and characteristics of Composite materials. Applications of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements.
Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. iso-strain and iso-stress conditions.

UNIT – III

Manufacturing of Polymer Matrix Composites: Preparation of Molding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression molding – Reaction injection molding. Properties and applications.

UNIT – IV

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT – V

Composites joining methods: Adhesive joints, design of Adhesive Joints, Types of adhesives, Mechanical Joints, pin-loaded hole' joint type, Surface pressure and stress around a hole, Failure of mechanical joints, Use of inserts, Screwed connections, Bolted connections, hybrid and other joints

Text Books :

1. Krishan K. Chawla - Composite Materials: Science and Engineering, Springer.
2. Deborah D. L. Chung, Composite Materials: Science and Applications, Springer.
3. R.P.L. Nijssen, Composite Materials An Introduction, A VKCN publication.

Reference Books :

1. Ever J. Barbero - Introduction to Composite Materials Design, CRC press, Taylor & Francis.
2. T.W. Clyne, D. Hull – An Introduction to composite Materials, Materials Research Society, Cambridge University Press.
3. Daniel Gay,Suong V.Hoa, Stephen W.Tsai – Composite Materials Design and Applications, CRC press

Question Paper Pattern:

1. Sessional Examination: The question paper for internal examination shall be for **30** Marks. The question paper shall contain **Three** questions and the student has to answer **Three** questions (**without choice**). Each Question carries **10** marks.
2. End Examination: The question paper for End examination shall be for **60** marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries **12** marks.

Professional Elective – II

<table>
<tr><th colspan="8">ADVANCED MATERIALS ENGINEERING (AME)</th></tr>
<tr><td colspan="5">I Semester : AMT PE-II</td><td colspan="3">Scheme : 2025</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="2">Maximum Marks</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">PE</td><td>L</td><td>T/D</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>TOTAL</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Sessional Exam Duration : 2 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="8">Course Outcomes : At the end of the course the student will be able to</td></tr>
<tr><td colspan="8">CO1: Explain the metallurgical aspects and applications of nonferrous alloys, high alloy steels, and super alloys.</td></tr>
<tr><td colspan="8">CO2: Describe the classification, reinforcement types, matrix materials, and applications of composite materials in various fields.</td></tr>
<tr><td colspan="8">CO3: Outline the classification, properties, and applications of smart materials, including shape memory alloys.</td></tr>
<tr><td colspan="8">CO4: Apply the concepts of biomaterials to evaluate property requirements, biocompatibility, and applications of Ni–Ti and Co–Cr–Mo alloys.</td></tr>
<tr><td colspan="8">CO5: Analyze the properties and applications of special materials used in rockets, missiles, fire-safety systems, and the nuclear industry.</td></tr>
<tr><td colspan="8">UNIT – I</td></tr>
<tr><td colspan="8">Nonferrous Alloys, High Alloy Steels and Super Alloys: Aluminum alloys, Magnesium alloys, Copper alloys, Nickel alloys, Titanium alloys, Zinc alloys, stainless steels, Maraging steels Metallurgical aspects and applications .super alloys (Nickel based super alloys, Cobalt based super alloys).</td></tr>
<tr><td colspan="8">UNIT – II</td></tr>
<tr><td colspan="8">Composites: Classification of composite materials, Types of Reinforcements, types of Matrix material, Polymer composites, metal matrix composites, ceramic matrix composites. Special kinds of composites for Marine applications, Fire-Resistant Composites, Composite Materials in Alternative Energy Sources.</td></tr>
<tr><td colspan="8">UNIT – III</td></tr>
<tr><td colspan="8">Smart Materials: Classification of smart materials (Piezoelectric materials, Electro-rheological fluid, Magneto-rheological fluids),Shape Memory alloys, Shape memory effect, Material Systems of Different Shape Memory Alloys, Applications of Shape Memory Alloys in Different Fields.</td></tr>
<tr><td colspan="8">UNIT – IV</td></tr>
<tr><td colspan="8">Biomaterials: Property requirement, biocompatibility, bio functionality, Important bio metallic alloys like: Ni-Ti alloy and Co-Cr-Mo alloys. Applications.</td></tr>
<tr><td colspan="8">UNIT – V</td></tr>
<tr><td colspan="8">Special Materials in Specialized Applications: Materials for Rocket and missile, Materials in Safety System against Explosion and Fire (or Fusible Alloys), Metals and Alloys for Nuclear Industry.</td></tr>
<tr><td colspan="8">Text Books :</td></tr>
<tr><td colspan="8">1. Engineering Materials Research, Applications and Advances – K.M. Gupta, CRC Press, Taylor & Francis Group.
2. Engineering materials and Their Applications - Richard A. Flinn, Paul K. Trojan, Houghton Mifflin Company.</td></tr>
<tr><td colspan="8">Reference Books :</td></tr>
<tr><td colspan="8">1. Advanced Materials An Introduction to Modern Material Science – Ajit Behera, Springer
2. Foundations of Material Science and Engineering – William Smith, Javad Hashemi, McGraw Hill
3. Material science and Engineering An Introduction – William D. Callister, Jr. David, G. Rethwisch, Wiley Publications.</td></tr>
<tr><td colspan="8">Question Paper Pattern:</td></tr>
<tr><td colspan="8">1. Sessional Examination: The question paper for internal examination shall be for 30 Marks. The question paper shall contain Three questions and the student has to answer Three questions (without choice). Each Question carries 10 marks.
2. End Examination: The question paper for End examination shall be for 60 marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries 12 marks.</td></tr>
</table>

DESIGN OF ADVANCED HYDRAULIC AND PNEUMATIC SYSTEMS (DAHPS)

I Semester : AMT PE-II					Scheme : 2025			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	PE	**L**	**T/D**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course the student will be able to

CO1: Recognise the Importance of Hydraulics and Pneumatics Controls

CO2: Explore the control of various types of valves.

CO3: Understand the concepts of Hydraulic Actuators.

CO4: Understand the design of hydraulic circuits and applications.

CO5: Understand the concepts and functioning of pneumatic systems.

UNIT – I

Introduction: Power hydraulics & its applications, Hydraulic symbols,
Positive displacement Pumps: Gear, Vane, Piston and other special types of pumps.

UNIT – II

Control Valves: Pressure Control: relief valve, Unloaded valve, Pressure reducing valve, Counter balance valve, sequence valve, Flow Control: Meter in Meter out, Bleed off, Pressure and Temperature, compensated flow control valve, Direction Control: Check valve, Open centre, closed centre, Tandem centre and others, Cartridge valves, Flow forces on valve spools.

UNIT – III

Hydraulic Actuators: Linear and rotary, Design of Hydraulic actuators, Accessories in hydraulic systems: Accumulator, Air-breathe valve, Pressure switches etc. Hydraulic power packs.
Servo valves: Torque motor, electro-hydraulic Servo valves: Types and principles of operations.

UNIT – IV

Design of Hydraulic Circuits and its Application: Regeneration, Pre-fill, Twin Pump and others. Maintenance of hydraulic systems and working fluid:

UNIT – V

Pneumatics: Air Filter, Lubricators and Regulators, Pneumatic control elements: Air Cylinders and their Design, Pneumatic safety circuits, Pneumatic Logic control.

Text Books :

1. H.E. Merritt, “Hydraulic Control Systems”, John Wiley & Sons, New York.
2. D. Mc Cloy and H. R. Martin, “Control of Fluid Power, Analysis, Design and Control”, John Wiley & Sons.

Reference Books :

1. Andrew Parr, Hydraulics and Pneumatics, Jaico Publishers.
2. Esposito, Fluid Power by Esposito, Pearson Education.

Question Paper Pattern:

1. Sessional Examination: The question paper for internal examination shall be for **30** Marks. The question paper shall contain **Three** questions and the student has to answer **Three** questions (**without choice**). Each Question carries **10** marks.
2. End Examination: The question paper for End examination shall be for **60** marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries **12** marks.

DESIGN FOR MANUFACTURING AND ASSEMBLY (DFMA)

I Semester : AMT PE-II					Scheme : 2025			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	PE	**L**	**T/D**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course the student will be able to

CO1: Describe the concepts of manufacturability in design, including process capability and tolerance analysis.

CO2: Explain the factors influencing form design, including working principle, material selection, manufacturing considerations, and design of welded, forged, and cast components.

CO3: Analyze component design considerations for machining, assembly, accessibility, clampability, and economic manufacturability**.**

CO4: Analyze component design considerations for casting**,** including parting line selection, core minimization, economical design, and DFMA computer applications.

CO5: Analyze the principles and methods of Design for the Environment (DFE)**,** including lifecycle assessment and techniques to reduce environmental impact.

UNIT – I

Introduction: General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits - Datum features - Tolerance stacks.

UNIT – II

Factors Influencing Form Design: Working principle, Material, Manufacture, Design- Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

UNIT – III

Component Design - Machining Consideration: Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability – Design for accessibility - Design for assembly.

UNIT – IV

Component Design – Casting Consideration: Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

UNIT – V

Design For The Environment: Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T‟s environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.

Text Books :

1. Boothroyd, G, Design for Assembly Automation and Product Design. New York, Marcel Dekker.
2. John Dixon, Corroda Poli - Engineering Design& Design for Manufacturing: A Structural Approach, Field Stone Publisher.
3. Joseph Fiksel - Design for the Environment, McGraw Hill.,

Reference Books :

1. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker.
2. T.E.Graedel, Braden R. Allenby.- Design for the Environment, Pearson.
3. Kevien Otto and Kristin Wood, Product Design. Pearson Publication, 2004.

Question Paper Pattern:

1. Sessional Examination: The question paper for internal examination shall be for **30** Marks. The question paper shall contain **Three** questions and the student has to answer **Three** questions (**without choice**). Each Question carries **10** marks.

2. End Examination: The question paper for End examination shall be for **60** marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub-questions. And the student should answer any one question from each unit. Each Question carries **12** marks.

Audit Course – I

<table>
<tr><td colspan="8">ENGLISH FOR RESEARCH PAPER WRITING (ERPW)</td></tr>
<tr><td colspan="4">I Semester : AMT – AC-I</td><td colspan="4">Scheme : 2025</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="2">Maximum Marks</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">AC</td><td>L</td><td>T/D</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>TOTAL</td></tr>
<tr><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Sessional Exam Duration : -</td><td colspan="4">End Exam Duration: -</td></tr>
<tr><td colspan="8">Course Outcomes : At the end of the course the student will be able to</td></tr>
<tr><td colspan="8">CO1: Understand that how to improve your writing skills and level of readability</td></tr>
<tr><td colspan="8">CO2: Learn about what to write in each section</td></tr>
<tr><td colspan="8">CO3: Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission</td></tr>
<tr><td colspan="8">UNIT – I</td></tr>
<tr><td colspan="8">Paragraph Basics, Logical Order and Transitions
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness</td></tr>
<tr><td colspan="8">UNIT – II</td></tr>
<tr><td colspan="8">Paraphrasing Plagiarism and Basic of Paper Writing
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction</td></tr>
<tr><td colspan="8">UNIT – III</td></tr>
<tr><td colspan="8">Structure of Research Paper
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.</td></tr>
<tr><td colspan="8">UNIT – IV</td></tr>
<tr><td colspan="8">Essential Key Skills Required-I
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,</td></tr>
<tr><td colspan="8">UNIT – V</td></tr>
<tr><td colspan="8">Essential Key Skills Required-II
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission</td></tr>
<tr><td colspan="8">Text Books :</td></tr>
<tr><td colspan="8">1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)</td></tr>
<tr><td colspan="8">2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press</td></tr>
<tr><td colspan="8">Reference Books :</td></tr>
<tr><td colspan="8">1. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman’s book.</td></tr>
<tr><td colspan="8">2. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011</td></tr>
</table>

DISASTER MANAGEMENT (DM)

I Semester : AMT – AC-I					Scheme : 2025			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T/D**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
	AC	**2**	**-**	**-**	**-**	**-**	**-**	**-**
Sessional Exam Duration : -					**End Exam Duration: -**			

Course Outcomes : At the end of the course the student will be able to

CO1: Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO2: Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO3: Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO4: Critically understand the strengths and weaknesses of disaster management approaches,

CO5: Planning and programming in different countries, particularly their home country or the countries they work in

UNIT – I

Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT – II

Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT – III

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT – IV

Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT – V

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Text Books :

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “’New Royal book Company.

Reference Books :

1. Sahni, Pardeep Et. Al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall ofIndia, New Delhi.
2. Goel S. L., Disaster Administration and Management Text and Case Studies”, Deep & Deep Publication Pvt. Ltd., w Delhi.

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (EITK)

I Semester : AMT – AC-I					Scheme : 2025			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
	AC	L	T/D	P	C	Continuous Internal Assessment	End Exam	TOTAL
		2	-	-	-	-	-	-
Sessional Exam Duration : -					End Exam Duration: -			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the concept of Traditional knowledge and its importance.

CO2: Explain the need and importance of protecting traditional knowledge.

CO3: Illustrate the various enactments related to the protection of traditional knowledge.

CO4: Interpret the concepts of Intellectual property to protect the traditional knowledge.

CO5: Understand the traditional knowledge in different sectors.

UNIT-I

INTRODUCTION TO TRADITIONAL KNOWLEDGE

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

UNIT-II

PROTECTION OF TRADITIONAL KNOWLEDGE

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT-III

LEGAL FRAME WORK AND TK

A. A. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, The Protection of Plant Varieties and Farmers' Rights Act, 2001 (PPVFR Act).
B. The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.

UNIT-IV

TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT-V

TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. 139.

***Textbooks*:**

1. 'Traditional Knowledge System in India' by Amit Jha.

***Reference Books*:**

1. 'Traditional Knowledge System and Technology in India' by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan.
2. 'Traditional Knowledge System in India' by Amit Jha Atlantic publishers.
3. 'Knowledge Traditions and Practices of India' by Kapil Kapoor and Michel.

***Web References*:**

1. www.youtube.com/watch?v=LZP1StpYEPM
2. https://nptel.ac.in/courses/121106003