Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for

M.Tech.(Production Engineering)

Semester-I

(Effective from the session: **2022-23**)

SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
FACULTY OF ENGINEERING

Two Years M.Tech. Programmme
Scheme of Teaching and Examination
M.Tech. First Semester Production Engineering
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the session: 2022-23)

S.N	Course Code	Course Title	Hours per week			Credit	Examination Scheme			Sem End Exam Duration (Hrs)
			L	T	P		Continuous Evaluation	Sem End Exam	Total	
1.	MSCCP101T	Advanced Computational Methodology	3	1	-	4	30	70	100	3
2.	MENPE102T	Welding and Additive Manufacturing	3	1	-	4	30	70	100	3
3.	MENPE102P	Welding and Additive Manufacturing-Lab	-	-	4	2	15	35	50	-
4.	MENPE103T	Advance Casting Process	3	1	-	4	30	70	100	3
5.	MENPE103P	Advance Casting Process- Lab	-	-	4	2	15	35	50	-
6.	MENPE104T	Elective-I	3	1	-	4	30	70	100	3
7.	MENPE105T	Quality System Engineering	3	1	-	4	30	70	100	3
						24			600	

L – LECTURE T- TUTORIAL P- PRACTICAL

I	Engineering Materials and Characterization	MENPE104A
II	Production Processes	MENPE104B
III	Manufacturing of Plastic Products	MENPE104C

<table>
<tr><td>Course Title</td><td colspan="5">ADVANCED COMPUTATIONAL METHODOLOGY</td></tr>
<tr><td>Course Code</td><td colspan="5">MSCCP101T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">ENGINEERING MATHEMATICS –I, II & III</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
Represent the problems mathematically.
Optimize the solutions.
Analyze the result numerically and linguistically by fuzzy theory.
Emphasize the meaning and purpose of these techniques and their use in solving Engineering Problems.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT – I
Graph theory and its application
Basic Terminology, Simple graph, Multi graph, Types of graph, Path Cycles Eulerian and Hamiltonian graph Shortest path problem Representation of graph Trees and their properties Spanning, Tree Binary Tree, Tree traversal.
UNIT - II
Fuzzy Set and its Applications
Fuzzy sets-Basic definitions, α-level sets. Convex fuzzy sets. Basic operations on fuzzy sets. Types of fuzzy sets. Cartesian products, Algebraic products. Bounded sum and difference, t-norms and t-conorms. The Extension Principle- The Zadeh’s extension principle. Image and inverse image of fuzzy sets. Fuzzy numbers. Elements of fuzzy arithmetic.
UNIT - III
Cryptography and its application
Introduction to the Concepts of Security: The need for security, Security Approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks. DES, RSA, Digital Signature.
UNIT - IV
Statistical Analysis</td></tr>
</table>

	Expectation and variance of random variable. Sampling Distribution. Testing a Hypothesis. Level of significance. Confidence limits. Test of significance for large sample. Central limit theorem. Test of significance for means of two large samples. Sampling Variables-small samples. Student t-distribution, Chi-square test. **UNIT - V** **Optimization Techniques** Dynamic Programming-Deterministic and Probabilistic Dynamic programming. Inventory- Basic characteristics of an inventory system. The Economic order quantity. Deterministic models. Network analysis (PERT/ CPM).
Course outcomes	**After the completion of course:** 1. This is the foundation of research and development in the computational domain of engineering and technology. 2. As the prerequisite, this will be traced the thought and ideas to design the behavioral tools over the engineering range. 3. This is a transformation from theory to application through measuring theory of natural problems and its applications
Text Books	1. Calculus of Variations with Applications, Gupta, A.S. Prentice Hall of India(P) Ltd., N e w Delhi, 6th print,2006. 2. Introduction to Partial Differential Equations, Sankar Rao, .K Prentice Hall of India(P) Ltd., New Delhi, 5th print, 2004. 3. Advanced Engineering Mathematics, Jain.R.K, Iyengar.S.R.K. Narosa publications 2nd Edition, 2006. 4. Numerical Methods in Science and Engineering, Grewal, B.S - Kanna Publications, New Delhi. 5. Numerical Methods, Kandasamy.P , Thilagavathy. K and Gunavathy, S Chand and Co., Ltd., New Delhi, 5th Edition, 2007. 6. Theory and problems of Complex Variables with an Introduction to Conformal Mapping and Its applications, Schaum's outline series, Spiegel, M. R - Mc Graw Hill Book Co., 1987.
Reference Books	1. Multi - Objective Optimization Using Evolutionary Algorithms, K. Deb(2003)John Wiley. 2. Applied Statistics & Probability for Engineers: Montgomery, Douglas C. & Runger, George C. (2007), 3/e,Wiley India. 3. Parallel distributed processing Vol.1 (1986) Rumelhart, D.E and McClelland, J.L., M I T Press, 1986. 4. Fuzzy logic implementation and applications (1996), Patyra, M.J. and Mlynek Wiley.

Course Title	**WELDING & ADDITIVE MANUFACTURING**				
Course Code	**MENPE102T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**MANUFACTURING PROCESS –I , II , WELDING TECHNOLOGY**				
Course objectives	**This course will enable students:** • To perform on of the welding techniques and understand important of arc welding. • Define the problem that occurs on the arc welding. • Recognize the type of metal, electrode, and tools that are used in arc welding. • Recognize types of arc welding and steps to create the arc welding. • To know safety measure when use the welding machine along the welding process. • To recognize the Additive Manufacturing builds up components layer by layer using materials which are available in fine powder form.				
Course Contents	**UNIT- I** **Introduction to welding** Processes, Classification of joining processes; Type of welds and weld joints; Welding symbols and codes; Arc welding processes; Laser welding; Electron beam welding; Resistance spot welding; Friction welding; friction stir welding;. **UNIT- II** **Weld testing methods** destructive and non-destructive; Analysis of welded structure for fatigue loading; Analytical solution of temperature distribution; Distortion and residual stress and their measurement; **UNIT- III** **Characteristics of welding** Types of power sources, Current-voltage and arc power – arc length characteristics; Synergic and pulsed welding; Forces on molten droplet, Mode of metal transfer in arc welding; Cold metal transfer. Analysis of heat flow, Cooling rates; Models for welding heat sources, Analytical solution of temperature distribution Analysis of heat flow, Cooling rates; Models for welding heat sources.				

	UNIT- IV **Chemical reactions in welding** Solidification in welding and solidification cracking; Phase transformation in welded structure; Weld microstructure; Heat treatment of weld joint; Types of welding defects, their cause and remedies. **UNIT- V** **Additive manufacturing** Introduction; Classification; Principle, Welding technology-based metal 3D printing; Solid state additive manufacturing, Additive vs. subtractive manufacturing.
Course outcomes	**At the end of this course students will be able to:** 1. Additive manufacturing allows for the creation of objects with precise geometric shapes. **2.** These are built layer by layer which is in contrast to traditional manufacturing that often requires machining or other techniques to remove surplus material. **3.** Use safe practices in the welding environment related to personal conduct, use of tools and equipment and exposure to hazardous materials and conditions in accordance with the Occupational Health and Safety Act and Regulations for industrial establishments. **4.** Utilize blueprints and shop drawings to achieve specified weldment configurations.
Text Books	1. A. O'Brien, Welding Handbook: Welding Processes, Part 1, Vol. 2, 9th Ed., American Welding Society, 2007 2. J. F. Lancaster, The Physics of welding, Pergamon, 1986. 3. R. W. Messler, Principles of Welding, John Wiley and Sons, 1999 4 S. Kou, Welding Metallurgy, 2nd Ed., Wiley Interscience, 2003
Reference Books	1. V. M. Radhakrishnan, Welding technology and design, New Age International Private Ltd., 2nd Ed., 2005. 2. R. S. Parmar, Welding Processes and Technology, Khanna Publishers, 3rd Ed., 2015. 3. J. A. Goldak, Computational Welding Mechanics, Springer, 2005 8. W Steen, Laser Material Processing, Springer-Verlag, 1991. 4. I Gibson, D. W. Rosen, B. Stucker, Additive Manufacturing Technologies, Springer, 2010.

Course Title	**ADVANCE CASTING PROCESS**				
Course Code	**MENPE103T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**BASIC MECHANCIAL ENGINERRING, MANUFACTRUING I & II**				
Course objectives	**This course will enable students: -** • To inculcate the principle, thermal and metallurgical aspects during solidification of metal and alloys. • To impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting, defects in cast objects and requirements for achieving sound casting.				
Course Contents	**UNIT-I** **Production of Mould** Moulds Cores, Mould production - equipment for moulding, moulding technique - pattern utilisation, hand and machine compaction, machine moulding, mould drying and hardening. Cores and core making - core boxes, compaction, core hardening, closing of moulds. **UNIT-II** **Melting and Pouring** Melting Practice: Classification of melting furnaces, brief description of construction and operation of various furnaces - cupola and its design, electric arc furnaces, electric induction furnaces. Melting charge, melting conditions, melting losses, special melt treatment, melt quality control and recent development in metal melting. Pouring: Metal temperature, pouring equipment and techniques. **UNIT-III** **Casting Techniques** Shell moulding - Basic operation, production systems, characteristics of shell moulded casting and D-process. Investment Casting - expandable pattern process. Pattern production, investment, pattern removal and firing, casting. Factor influencing casting quality characteristics of precision investment casting. Investment casting from permanent casting. Die-casting - Gravity die-casting, pressure-die casting, die-casting machines, casting techniques, characteristics of die - castings. Centrifugal casting - Fundamental principles, methods production				

	techniques, characteristics of centrifugal casting. **UNIT-IV** **Solidification of Castings** Crystallization and development of cast structure - Nucleation, Growth and dendrite growth, independent nucleation, eutectic freezing, paratactic relations, structure of castings - significance and practical control cast structure, grain shape and orientation, grain size, refinement and modification of cast structure. Concept of progressive and directional solidification, solidification time and derivation of Chvorinov's equation influence of mould characteristics and cast metal. Properties on solidification, process numerical methods for heat flow analysis. **UNIT-V** **Feeding of Castings** Feeding characteristics of alloys, geometric influences on solidification. Methods of the feeding of castings - cost and concept of yield, orientations, gating technique, casting temperature and pouring speed, design and location of feeder heads. Aids to feeder head efficiency, junction of feeder head and casting, use of padding, chills and insulators.
Course outcomes	**At the end of this course students will be able to: -** 1. Analyze the thermal, metallurgical aspects during solidification in casting and welding and their role on quality of cast or weld objects. 2. Design the gating and riser system needed for casting and requirements to achieve defect free casting.
Text Books	1. Ramana Rao, T. V., Metal Casting – Principles and Practice, New Age International Pvt. Ltd. (2003). 2. Rao, P. N., Manufacturing Technology, McGraw Hill (2008). 3. Campbell, J., Castings, Butter Worth – Heinemann Publishers (2003). 4. Nadkari, S. V., Modern Arc Welding Technology, Oxford & India Book House Pvt. Ltd. (2005).
Reference Books	1. Beeley P.R., "Foundry Technology" (Buttersworth) 2. .Heine and Rosenthal, "Principles of Metal Cutting" (TMH) 3. "Metal Casting" ASME Handbook. 4. .P.C.Mukherji, "Metal Casting Technology"

<table>
<tr><td>Course Title</td><td colspan="5">QUALITY SYSTEM ENGINEERING</td></tr>
<tr><td>Course Code</td><td colspan="5">MENPE105T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">QUALITY CONTROL, OPERATION RESEARCH</td></tr>
<tr><td>Course objectives</td><td colspan="5">This course will enable students: -
To impart knowledge about the significance of quality and the various tools/ concepts of building quality into products.
To learn the techniques used for quality control and quality improvement.
To impart knowledge about plans for acceptance sampling and quality systems.
Differentiate between product quality characteristics and service quality characteristics.
Distinguish between quality of design and quality of conformance to design
Explain the process of planning for quality.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I
Fundamental of Quality
Fundamental of Quality, Contribution of quality gurus, quality cost. Statistical process control & process capability. Acceptance Sampling plans for attribute and variable.
UNIT-II
Taguchi method
Taguchi quality loss function and concept of robust design. Concept of six sigma, FMEA, QFD, Poka Yoke. ISO 9000 series of standard, QS 9000, TQM, Quality circles. Benchmarking. Reliability.
UNIT-III</td></tr>
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	Quality management The Foundations of Total Quality Management, Components of quality, The total quality management approach, Innovation, design and improvement. Product quality characteristics and service quality characteristics, Quality parameters and specific dimensions of quality. **UNIT-IV** **Total quality management** TQM Tools and the Improvement Cycle Measurement of quality Costs of quality Tools and techniques for quality improvement, Statistical process control Quality improvement techniques in service industries, Specific techniques for design, reliability, maintenance and process improvement **UNIT-V** **Planning for quality** Flowcharting - Detailed flow process charts and flow diagrams - Planning for just-in-time (JIT) management, System design and contents, System documentation, implementation and assessment.
Course outcomes	**students should be able to:** 1. Apply the tools and techniques of quality to resolve industrial engineering issues. 2. Estimate the obvious and hidden quality costs for a given production system. 3. Apply a system based approach for quality management. 4. Prepare and analyze various charts/ methods for quality control and improvement. 5. Use plans for sampling and concepts of quality system management. 6. Identify and explain specific tools and techniques for quality improvement.
Text Books	1. Juran, J.M. and Gryna, F.M, Quality Planning & Analysis, McGraw Hill (2001). 2. *Grant, E.L., Statistical Quality Control, McGraw Hill (2008).* 3. Feignbaum, A.V., Total Quality Control, McGraw Hill (1991). 4. Juran, J.M., Juran's Quality Control Handbook, McGraw Hill (1988).
Reference Books	1. Amitava Mitra –Fundamentals of Quality Control & Improvement, Mcmillan Publishing Company.

	2. OAKLAND, J.S. Total Quality Management – the route to improving performance Butterworth/Heinemann (1993). 3. HOYLE, D. ISO 9000 Quality Systems Handbook 2nd Edition Butterworth/Heinemann 1997. 4. TENNER, A.R. & De TORO I.J. Total Quality Management – Three Steps to Continuous Improvement.

Course Title	**WELDING & ADDITIVE MANUFACTURING -LAB**				
Course Code	**MENPE102P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**4**	**2**	
Prerequisites	**MANUFACTURING SCIENCE, WORKSHOP PRACTICE I & II**				

Course objectives

This course will enable students: -

- Develop STL file for CAD models with appropriate support structures and orientation.
- Build complex engineering assemblies in plastic material with minimum build-time.
- Evaluate the process parameters of AM machine to improve the quality of the parts produced.
- Model and fabricate working models using AM processes.

Course Contents

LIST OF EXPERIMENTS

Welding Lab:

1. ARC Welding Lap & Butt Joint – 2 Exercises
2. Spot Welding – 1 Exercise
3. TIG Welding – 1 Exercise
4. Plasma welding and Brazing – 2 Exercises (Water Plasma Device)

Additive manufacturing Lab:

1. Introduction to Additive Manufacturing
2. Generating STL files from the CAD Models & Working on STL files
3. Modeling Creative Designs in CAD Software
4. Processing the CAD data in Catalyst and CURA softwares
5. Simulation in Catalyst Software for optimizing build-time and material consumption
6. Sending the tool path data for fabricating the physical part on RP machine
7. Removing the supports & post processing (cleaning the surfaces)
8. Evaluating the quality of the fabricated part in terms of surface finish and dimensional accuracy.
9. Evaluating the fabricated part for its suitability to a given application.

Course outcomes	**This course will enable students**: - 1. Additive manufacturing allows for the creation of objects with precise geometric shapes. **2.** These are built layer by layer which is in contrast to traditional manufacturing that often requires machining or other techniques to remove surplus material. **3.** Use safe practices in the welding environment related to personal conduct, use of tools and equipment and exposure to hazardous materials and conditions in accordance with the Occupational Health and Safety Act and Regulations for industrial establishments.
List of Equipment's	Arc welding m/c Spot welding m/c TIG welding m/c MIG welding m/c Soldering brazing & brassing m/c Plasma welding m/c 3D printing m/c

Course Title	**ADVANCE CASTING PROCESS- LAB**				
Course Code	**MENPE103P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**4**	**2**	
Prerequisites	**WORKSHOP PRACTICE I &II, FOUNDARY TECNHOLOGY & MANUFACTURING SCIENCE**				
Course objectives	**This course will enable students: -** • To Constructing a sand-casting mold, pouring a cast, and comparing the actual casting against calculate values. • To Measure all dimensions of the assigned pattern used.				
Course Contents	**LIST OF EXPERIMENTS** 1. To prepare a mould for a given single piece pattern. 2. To prepare a split wooden pattern detailed below with allowance. 3. To prepare a green mould for casting using only two boxes. 4. To prepare the spure design gating & rising system in casting process. 5. To prepare the shell mould casting for different size of objects. 6. To mould prepare the shulsh casting of objects. 7. To study the centrifugal casting.				
Course outcomes	The students will be able to: 1. Illustrate the basic principles of foundry practices and special casting processes, their Advantages, Limitations and Applications. 2. Distinguish between basic manufacturing processes. 3. The student will be having the capability of selecting suitable manufacturing processes to manufacture the products optimally.				
Equipment's used	1. Open hearth furnace 2. Coal 3. Casting box & patterns 4. Sand materials, blowers, pump etc.				

Elective –I

Course Title	**ENGINEERING MATERIALS & CHARACTERIZATION**				
Course Code	**MENPE104A**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**APPLIED PHYSICS, PHYSICAL CHEMISTRY & MATERIAL SCIENCE & ENGINEERING**				
Course Objectives	**This course will enable students: -** • Understand the latest developments in material science and materials to cope up with requirements of industry. • Understand the developments in non-conventional manufacturing processes • To provide a technical understanding of common processes to aid in appropriate process selection for the material and required tolerances • To provide a technical understanding of common processes to aid in appropriate material selection for a predetermined process.				
Course Contents	**UNIT- I** **Classification of materials** Introduction: metals and alloys, ceramics, polymers and composite. Atomic bonding, crystal structure and grain morphology. Phase diagrams (Fe-Fe3C phase diagrams), TTT and CCT diagram. Heat treatment. **UNIT- II** **Strengthening mechanism** Metals Failure mechanisms: fracture, fatigue and creep. Classification of dislocation & Dislocation mechanism. Defects in metals. Plastic deformation mechanisms of metals, dislocation slip, deformation twinning, martensitic				

	transformation. **UNIT- III** **Powder metallurgy** Coating techniques. Composite fabrication: metal matrix, polymer matrix and ceramic matrix composites. Introduction to advanced materials: shape memory alloys, piezoelectric materials, biomaterials, super alloys, high entropy alloys. **UNIT- IV** **Mechanical characterization** Tensile test, hardness test, impact test, fracture/fatigue/creep test; X-ray diffraction (XRD) technique: characterization and analysis; Microscopy techniques and analysis of results: optical microscopy (OM), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS/EDX/EDAX). **UNIT- V** **Microscopy** **E**lectron backscatter diffraction (EBSD), transmission electron microscopy (TEM), atomic force microscopy (AFM), scanning tunneling microscopy (STM); Principles and applications of thermal analysis: differential thermal analysis (DTA), differential scanning calorimetric (DSC), thermo gravimetric analysis (TGA), thermo mechanical analysis (TMA), and dynamic mechanical analysis (DMA/DMTA).
Course outcomes	**The students should be able to:** 1. Discuss the relative advantages and disadvantages for the techniques covered in class. 2. Be able to identify and justify the selection of at least 3 techniques to evaluate a particular sample. 3. Be given an unknown sample (or have one from own research) and collect a targeted dataset on it using an instrument available on campus.
Text Books	1. W. D. Callister, Material Science and Engineering: an Introduction, Wiley,2002. 2. G. Dieter, Mechanical Metallurgy, Mc-Graw Hill, 1996. 3. R. F. Speyer, Thermal Analysis of Materials, Marcel Decker, 1994

Reference Books	1. B. Fultz and J. M. Howe, Transmission Electron Microscopy and Diffractometry of Materials, Springer 2008. 2. ASTM handbook, vol. 3, 1997 3. ASM hand book Materials characterization, Vol 10, 1998 4. C. R. Brundle, C. A. Evans Jr., S. Wilson, Encyclopedia of Materials Characterization, ButterworthHeinemann, 1992. 5. R. W. Cahn, and E. Lifshin, Concise Encyclopedia of Materials Characterization, Pergamon, 1993. 6. E. N. Kaufmann, Materials characterization, Wiley Interscience, 2003. 7. B. D. Cullitey, Elements of X-ray diffraction, Addison-Wesely, 1968. 8. 11. E. Lifshin, X Ray Characterization of Materials, Wiley-Vch 1999.

Elective-I

Course Title	**PRODUCTION PROCESS**				
Course Code	**MENPE104B**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**MANUFACTURING PROCESS & INDUSTRIAL ENGINEERING**				
Course Objectives	**This course will enable students: -** • To cultivate the ability to develop and implement new improved manufacturing processes resulting in creation and distribution of value in engineering applications. • To impart knowledge about the significance of controlling process parameters for the optimal performance for newly developed engineering materials used in industries and research organizations.				
Course Contents	**UNIT- I** **Welding Metallurgy**: Heat flow - temperature distribution-cooling rates - influence of heat input, joint geometry, plate thickness, preheat, significance of thermal severity number. Design requirements, allowable stress values, workmanship and inspection, introduction to welding codes and standards, AWSD. **UNIT- II** **Metal Cutting:**				

	Principles of metal cutting, tool geometry, Tool life plots, Mach inability, Tool wear, cutting force analysis, cutting tool materials & Cutting fluids, Economics of metal machining. **UNIT -III** **Rolling** General description of machines and process; Rolling of structural sections plates and sheets; construction of halls; hot and cold rolling techniques. **UNIT- IV** **Pattern Making:** Pattern and pattern making, pattern allowances; pattern design considerations, core, core boxes, and types of patterns. Cast Metals and Alloys, Family of cast irons, Melting and casting technology; Inoculation. Technology of steel and non-ferrous cast metals. Gases in metals. Melting furnaces and refractories. Casting defects Inspection, diagnosis and rectification. Mechanization and Automation (Use of robots) of Foundries, Casting Design, Wear net shape castings, Numerical modeling applied to castings. Pollution Control, Energy and waste management in foundries. **UNIT- V** **Forging:** Theory and application of forging processes description; principle of toleration of drop and horizontal forging machines; General principle of designs. **Press working:** Description and operation of processes, process of shearing, punching, piercing, blanking, trimming, perfecting, notching, lancing, embossing, coining, bending, forging and drawing press, tool dies, auxiliary equipment, safety devices, stock feeders, scrap cutters, forces, pressure and power requirements, requirements of stock material. **Spinning:** Introduction of spinning principle of spinning, application etc.
Course outcomes	**The students should be able to**: 1. Model the material removal in various modern manufacturing processes 2. Analyze the processes and evaluate the role of each process parameter during machining of various advanced materials. 3. Solve the various problems for the given profiles to be imparted on the work specimens. 4. Select the best process out of the available various advanced manufacturing processes for the given job assignment. 5. understand requirements to achieve maximum material removal rate and best quality of machined surface while machining various industrial engineering materials.
Text Books	1. Bosch Technical Instruction Booklets. 2. Tom Denton, Automotive Electrical and Electronic Systems, Edward Amold,1995.
Reference Books	1. Robert N.Brady, Automotive Computers and Digital Instrumentation,

	Prentice Hall, 1988.Duffy Smith, Auto Fuel Systems, 2. The god Heart Willcox Company Inc., Publishers, 1987. Heinz Heisler, Advanced Engine Technology. SAE Publications, 1995

Elective-I

Course Title	**MANUFACTURING OF PLASTIC PRODUCTS**				
Course Code	**MENPE104C**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**MANUFACTURING ENGINEERING, MATERIAL SCIENCE & ENGINEERING**				
Course Objectives	**This course will enable students: -** • overall knowledge on the manufacturing of plastic materials, their properties, applications, processing, product design, mold design, testing & quality control, and recycling through theory as well as practical training. • To meet the man power requirements of plastics and allied industries in India and overseas.				
Course Contents	**UNIT-I** **Introduction** polymeric materials, Engineering plastics, Polymer alloys, Selection of plastics. **UNIT-II**				

	Mechanical properties Degradation, Wear resistance, Frictional properties, Special properties, Structural features, Expanded plastics, Plastics as packaging material. **UNIT-III** **Theoretical aspects** Visco-elastic behaviour, Mathematical models for visco-elastic behaviour, Deformation behaviour of plastics, Reinforced plastics. **UNIT-IV** **Analysis of polymer melt flow** Newtonian and non-Newtonian fluid flow, Flow in circular section, Flow in rectangular section etc. **UNIT-V** **Plastics forming** Overview and analysis of various plastics forming operations; Extrusion, Injection moulding, Thermo-forming, Calendaring, Compression moulding, Blow moulding, Transfer moulding, Processing of reinforced plastics, Die design for simple components..
Course outcomes	**The students should be able to:** 1. Understanding product and its design 2. Selection criteria for Moulds and Dies on the base on the product quality, quantity, geometry and accuracy 3. Understand the other processing techniques for designing and fabricating the moulds and dies 4. Able to decide suitable mould material, machining method for mould manufacturing. 5. Understanding of basic knowledge of mould manufacturing 6. Knowledge of mould assembly of moving parts, Part inspection. 7. Basic of Plastic materials, properties and its moulding processes for mould or die design.
Text Books	1. James F. Stenvension, Innovation in Polymer Processing Moulding, Hanser Publishers, New York, 1996. 1. 2. Donald V. Rosato, Injection Moulding Handbook, International Thomson Publishing Company, 1985
Reference Books	1. Friedhelm Henson, Plastics Extrusion Technology, Hanser Publishers, New York,1988. 2. Brunt Strong, Plastics: Materials and Processing, Prentice-Hall, New Jersey, 1996. 3. William Patton, Plastics Technology: Theory, Design and Manufacture, Prentice Hall.