

GUJARAT TECHNOLOGICAL UNIVERSITY

AUTOMOBILE ENGINEERING AUTOMOTIVE MANUFACTURING SUBJECT CODE: 2150206 B.E. 5th SEMESTER

Type of course: Fundamental and advanced.

Prerequisite: Manufacturing Processes – I.

Rationale: The **Automotive manufacturing** course is to learn the basic processes available to make a part/product . It Will help the students to select the best manufacturing process based on quality/time/cost/mechanical properties.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	<p>MEATAL FORMING: Objective-Elastic and Plastic deformation of Metals-stress and strain curve-anisotropy in yielding. Hot and Cold working. Forging of metals- Forging processes- Forging machines- Forging load analysis- Forging defects. Drawing of rods, wires and tubes. Extrusion-load in Extrusion process-lubrication in Extrusion-defect in Extrusion. Rolling-process- Rolling mills-forces and geometrical relationships in rolling-defects in Rolling. Sheet metal forming-shearing processes-clearance-shearing forces-penetration-reduction in press load-shearing operations-strip lay out.Bending.stretch forming.Drawing processes.</p>	16	29
2	<p>LOCATING AND CLAMPING PRINCIPLES: Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements– principles of location – Locating methods and devices – Redundant Location–Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used. JIGSANDFIXTURES:- Design and development of jigs and fixtures for given component-Types of Jigs–Post, Turnover, Channel, latch, box, pot, angular post jigs– Indexing jigs–General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.</p>	10	18
3	<u>Joining Processes</u> :	10	18

	Joining techniques like welding, riveting, brazing, soldering used for sheet metal components, chassis frame components. Welding processes like spot , tungsten inert gas welding, metal inert gas welding, shielded metal arc welding,submerged arc welding , friction and electro-slag welding , electro beam welding, laser welding ,ultrasonic welding .Welding defects , Gas welding and cutting, Plasma arc cutting		
4	Metal Casting Processes: Patterns, Types of patterns, allowances and material used for patterns, moulding materials, moulding sands, Moulding sands properties and sand testing: Grain fineness, moisture content, clay content and permeability test. Core materials and core making. Moulding practices: Green, dry and loam sand moulding, pit and floor moulding; shell moulding; permanent moulding; carbon dioxide moulding. Metal casting: Melting furnaces: Rotary, Pit electric, Tilting and cupola. Review of casting processes, casting design considerations, capabilities and applications of casting processes; Gating and Rising design fundamentals, permanent mould casting, pressure die casting, centrifugal casting, continuous casting casting defects.	12	21
5	Advanced Manufacturing Processes : Use of EDM, ECM, ECG, USM,PAM, LBM for manufacturing of automobile components. Super Finishing Processes: Introduction to Grinding, Lapping, Honning, Buffing, Barrel Tumbling, Burnishing, Powder coating, Polishing.	08	14
	Total Hours	56	100%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
10	16	15	14	15

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom’s Taxonomy)

Reference Books:

- 1 Manufacturing Engineering And Technology By S. Kalpakjian, Pearson.
- 2 Manufacturing Processes, Kalpakjian, Pearson
- 3 Degarmon’s Materials and Processes in Manufacturing, 11th Ed. Black, Ronald A Kohser, Wiley India
- 4 Manufacturing Processes and Systems, 9th Ed. Phillip F., Ostwald, Jairo Munoz, Wiley India
- 5 Production technology, by R.K. Jain, Khanna publishers.
- 6 Production Technology by P.C. Sharma S Chand & Co Ltd.
- 7 Manufacturing Technology Vol. II, By P.N. Rao, Tata McGraw Hill.
- 8 Welding Technology, by O. P. Khanna, Dhanpat Rai publishers.
- 9 Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd.,New Delhi, 2004.
- 10 Joshi P.H “Press tools - Design and Construction”, wheels publishing, 1996
- 11 K. Venkataraman, “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005.
- 12 Donaldson, Lecain and Goold “Tool Design”, III rd Edition Tata McGraw Hill, 2000.
- 13 Kempster, “Jigs and Fixture Design”, Hoddes and Stoughton – Third Edition 1974
- 14 14.Hoffman “Jigs and Fixture Design” – Thomson Delmar Learning, Singapore, 2004.
- 15 ASTME Fundamentals of Tool Design Prentice Hall of India.

Course Outcome:

After learning the course the students should be able to:

- 1 Identify and select the methods of forging – for gudgeon pin, Crankshaft, connecting rod, camshaft, rocker arm, gears, shaft & axles, material suitability for above components ,forging equipments, forging defects .
- 2 Identify and select the Joining techniques like welding, riveting, brazing, soldering used for sheet metal components, chassis frame components and care to be taken during the operation.
- 3 Select the non-conventional machining like EDM, ECM, ECG,USM,PAM,,LBM for manufacturing automobile components.
- 4 Identify and select the sheet metal working methods for body components, wheel disc, different covers, fuel tanks, chassis frame components.
- 5 Identify the proper casting method for engine cylinder, cylinder head etc.
- 6 Design the jig and fixture for given component
- 7 Design press tool die for given component and optimize the strip lay out for given sheet metal component.
- 8 Design the pattern and select the moulding and casting method for given automotive component.

Following experiments are suggested for Laboratory work which itself becomes Design based Problems (DP)/ Open Ended Problem-

- 1 To study the pattern allowances and to make the drawing of pattern of given automotive part.
- 2 To study the investment and centrifugal casting and casting defects.
- 3 To study the resistance welding and TIG welding and its applications in automotive industry.
- 4 To study the non conventional machining and its applications in automotive industry.
- 5 To make the strip lay out of given sheet metal part of an auto vehicle.
- 6 To calculate the punch and die size of given part.
- 7 To design and draw the JIG and FIXTURE of given automotive component.
- 8 To find the no of drawing stages to make the given part by deep drawing method.

Related industrial visit is suggested for enhancement of student practical knowledge.

Facility of equipments at Institute level:

- 1 Pattern making and foundry shop
- 2 Welding Machine (Arc/Resistance, TIG, MIG etc.)
- 3 Mechanical and hydraulic press with operation facility.
- 4 Working model of Jig and Fixture
- 5 EDM-USM

List of Open Source Software/learning website:

1. <http://nptel.ac.in/>
2. www.learnerstv.com
3. <http://auto.howstuffworks.com/>
4. nptel.iitk.ac.in/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate

chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.