



Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Automobile Engineering	Semester	III
Course Code	20AT34P	Type of Course	Programme Core
Course Name	Automotive Manufacturing Processes	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale: Manufacturing process is a branch of professional engineering that shares many common concepts and ideas with other fields of engineering such as mechanical, chemical, electrical, and industrial engineering. The manufacturing or production engineer's primary focus is to turn raw material into an updated or new product in the most effective, efficient & economic way possible. The objective of the course is to develop skill in the most important manufacturing processes in to a context of a production environment.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Review a given drawing to identify the metal to be used, select the appropriate welding method and the right electrodes to be used.
CO-02	Build a sheet metal model using metal fabrication, brazing, lathe and drilling processes while adhering to all prescribed workshop safety protocols.
CO-03	Inspect the model to identify defects in welding processes using prescribed inspection procedure and also explain press work operation needed for any identified repair.
CO-04	Explain and implement the requirements of ISO standards 9000 series.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	3,4	1.Introduction to Welding Technology in Automobile Industry 2. Classification of welding and types of Welding Processes. 3. Arc Welding: Principle of Arc Welding- Types and preparation of materials in welding – Consumable Electrode method & Non-Consumable Electrode method. Steps involved in Arc Welding	Refer Table 1	1. a) Show various safety sign charts and Safety tips to be followed in the machine shop. Note down the Safety tips in the record book. b) Identify and record different Welding Joints in the Vehicle. 2. a) Practice on Material preparation for welding. b) Review the given drawing, Demonstrate and practice on selection of

					electrodes and setting the current, Arc initiation.
2	1	3,4	<p>1. TIG Welding – Construction- Working Principle- Material preparation- Process & Application.</p> <p>2. GTAW- Operation- Equipment & Materials- Joint Design- Application.</p> <p>3. GMAW- Operation- Equipment & Materials- Joint Design- Application.</p>	Refer Table 1	<p>1. Practice on Simple job work on Lap joint using metallic arc welding, GTAW & GMAW and Video demonstration & documentation of the same.</p> <p>2. Practice on Simple job work on butt joint using metallic arc welding, GTAW & GMAW and Video demonstration & documentation of the same.</p> <p>Note: Use Personal Protective equipment & follow the safety practices against fumes and welding gases (Record all the safety tips followed).</p>
3	1	3,4	<p>1. Resistance Welding- Principle- Construction & Working. Types of Resistance Welding.</p> <p>2. Working principle- Spot Welding, Butt Welding</p> <p>3. Seam Welding- Working Principle.</p>	Refer Table 1	<p>1. a) Demonstrate the safety precautions to be Practiced during spot welding and identify the welding method used to join the component in the given drawing.</p> <p>b) Case Study/ Industrial visit to metro, Aircraft outer bodies, Rail coaches etc. on spot welding and write a report on the same.</p> <p>2. a) Demonstrate the safety precautions to be</p>

					<p>Practiced during seam welding.</p> <p>b) Case study/ Industrial visit on Seam welding and write a report on the same.</p>
4	1,3	3,4	<p>1. Gas welding- Working process of Gas Welding and Gas cutting. Types of Gas Welding & Types of flames in Gas welding- Application.</p> <p>2. Welding Defects and remedies.</p> <p>3. NON-DESTRUCTIVE TESTS (NDT): Define NDT, Classify NDT methods, Visual inspection and its remedy.</p>	Refer Table 1	<p>1.a) Practice on Simple job work on Lap joint using gas welding.</p> <p>b) Identify the method of welding used to join the components in the given drawing and note down the electrode/binding material used.</p> <p>2. a) Practice on Gas cutting.</p> <p>b) Practice on Visual inspection of the cracks by Microscope.</p> <p>Note: Use Personal Protective equipment & follow the safety rules (Record all the safety tips followed).</p>
5	2,3	3,4	<p>1. Liquid Penetrant Testing – Basic steps in LPT, types of LPT and its remedy.</p> <p>2. Brazing: Introduction-Types, Joint design, Cleaning the joint</p> <p>3. Selecting the flux, Selection of a Brazing process, Post cleaning and inspections. Difference between brazing and welding.</p>	Refer Table 1	<p>1. Practice on Visual Inspection of the cracks by LPT and Video demonstration & documentation of the same.</p> <p>2. Practice on Brazing of different automobile components and Video demonstration & documentation of the same.</p> <p>Note: Follow the safety rules (Record all the safety tips followed).</p>

6	2	3,4	<p>1. Sheet Metal Technology- Introduction, Fundamentals of sheet metal work, Different hand tools used in automobile body shop.</p> <p>2. Sheet Metal operations: - Cutting operation-producing blanks, cutting holes, progressive, miscellaneous operation.</p> <p>3. Forming operation-bending, Embossing, flanging, hemming, seaming, curling, wiring.</p>	Refer Table 1	<p>1. Demonstrate and record different types of tools used in automobile body shop.</p> <p>2. Practice on Preparation of number plate using Embossing and rivet operation in sheet metal operation.</p> <p>Note: Follow the safety rules (Record all the safety tips followed).</p>
7	2,3	3,4	<p>1. Ribbing, staking, crimping, bulging, beading, enclosing, tube forming.</p> <p>2. Drawing operation- cupping, box drawing, panel drawing, Shallow, deep panel drawing.</p> <p>3. Introduction to Press working. Power press- Types- Working.</p>	Refer Table 1	<p>1. Demonstrate and prepare various sheet metals joint for any one application.</p> <p>2. Practice on any one drawing operation in sheet metal for any one application and Video demonstration & documentation of the same.</p> <p>Note: Follow the Sheet Metal fabrication safety tips.</p>
8	2	3,4	<p>1. Operations performed on press. Work & tool holding devices.</p> <p>2. Casting: Introduction to metal castings and moulding in foundry.</p> <p>3. Use of patterns, pattern materials.</p>	Refer Table 1	<p>1. Demonstrate the press work operation using hydraulic press.</p> <p>2. a) Demonstrate the Selection of right type of foundry tools and equipment. b) Practice on Sand mixing.</p>
9	2	3,4	<p>1. Types of patterns-single, split, loose</p> <p>2. Sweep pattern, skeleton pattern, Gated Patterns – allowances.</p>	Refer Table 1	<p>1. Practice on preparing the Square Mould.</p> <p>2. Practice on preparing the Hexagonal Mould.</p>

			3. Types of moulding sand and properties.		
10	2	3,4	<p>1. Concept of Cope, Drag. Concept of Runner, riser & core.</p> <p>2. Permanent mould casting –Die casting, Slush Casting.</p> <p>3. Centrifugal casting, investment casting. Brief explanation of defects in castings.</p>	Refer Table 1	<p>1. Practice on preparing the pattern cavity and provide runner and riser. (To show the concept of cope and drag)</p> <p>2. Melt Wax cast the same in the prepared pattern of the mould.</p>
11	2	3,4,7	<p>1. Forging: Introduction - Types- Working Processes of different types.</p> <p>2. Working of Open and Closed Die- Forging. Effects of forging on microstructure.</p> <p>3. Forging defects and their effects. Steel Forging in Automobile Industries- Need.</p>	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<p>1. Melt the Aluminium/ tin/ Cool drink Tin and cast the same in the prepared pattern of the mould using electric furnace.</p> <p>Note: Follow all the safety precautions.</p> <p>2. Demonstration of tools and equipment used in Forging operation. List & note down their functions.</p>
12	4	3,4,7	<p>1. ISO 9000 series Quality management system: History of International Organisation for standardization. ISO members. ISO standards and rules.</p> <p>2. History of ISO 9001. BS 5750. QM principle.</p> <p>3. The main requirements of ISO 9001.</p>	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<p>1. Practice on smith Forging of the given Material.</p> <p>2. Case study on ISO standards related to automotive industry.</p> <p>Note: Follow the safety precautions in the forging lab.</p>

13	2	3,4,7	<p>1. Lathe: Types-Construction & working of engine lathe- Turning, step turning, taper turning & knurling.</p> <p>2. Drilling: Working principle of Conventional drilling operation and its parts.</p> <p>3. Nomenclature of drill tool. Hole drilling operation- Reaming, Boring, Counter boring.</p>	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<p>1. Demonstrate different parts of lathe and practice turning, step turning, taper turning & knurling operations.</p> <p>2. Practice on drilling and counter boring of the given Sample.</p> <p>Note: Follow the safety practices.</p>
Total in hours			39	13	52

*** PO= Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course Co-Ordinator. (Above only suggestive)**

TABLE 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution).

Sl. No.	Week	Suggested Activity
1	1	Study and write a report on different welding methods used in automobile industry and submit as an assignment.
2	2	Study and present the use of Robot arc Welding or advanced arc welding operation in present automotive industries.
3	3	Create 6 groups in a class allow each group to study different arc and resistance welding joints in a given vehicle component. Note down and submit a report on components where the particular type of weld is used and justify with valid answer why that particular welding is done on that joint.
4	4	Study and prepare a report on Automotive NDT applications.
5	5	Study and submit a report on laser welding.
6	6	Study and present how high velocity forming is useful in automobile industry.
7	7	Study and Present on working of Sheet metal stamping and its application in automobile industry.
8	8	Study and write a report on Zinc die casting.
9	9	Study and submit the report on Evaporative pattern casting.
10	10	Study and Compare die casting Vs permanent mold casting or sand casting and submit the report on how each casting is different and their application in industry.
11	11	Study and present on Master bond epoxies used for automobile assembly application.
12	12	Visit nearby industry and know about different Forged components made in automobile and what methods/type of forging are adapted for these parts, submit the report.
13	13	Study and present on Drilling holes in automotive glass and Drilling hole in windshield glass for wiper evolution.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
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1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3.	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5.	CIE-5 Skill Test-Practice	12	180	100	
k	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. a) Format for CIE written Test

Course Name	Automotive Manufacturing Processes	Test	I/II/III	Sem	III/IV
Course Code	20AT34P	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5. b) CIE Skill Test-I Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1	Identify the safety tools used for performing different metal fabrication processes/sheet metal operation/drilling operation. - 10m Identify the appropriate metal to be used, appropriate welding method and the right electrodes to be used for a given component/draft. -5m	15
2	2	One skill-based question on “any one type of Welding operation”. a) Safety methods followed -10m b) Performance of the Operation - 30 m c) Accuracy - 05 m	45
3	3	One question on “NDT/ Brazing” a) Identification of defects/ Brazing -10 m b) Remedy/ Procedure followed before brazing -10 m	20
4	1,2,3	Portfolio evaluation of practical session (1-6) week	10

5	1,2,3	Viva-voce	10
Total Marks			100

5. c) CIE Skill Test-II Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	2	One skill-based question on "Sheet Metal operation operation". a) Safety methods followed -05m b) Performance of the Operation - 25 m	30
2	2	One skill-based question on "Casting/ Forging operation". a) Safety methods followed - 05m b) Performance of the Operation - 25 m	30
3	4	Question based on the given case in ISO standards in Organization management system. a) Identification of the key facts in the case - 05m c) Identification of the key issues - 05m d) Evaluate and recommend the course of action -10m	20
4	2,4	Portfolio evaluation of practical session (7-12) week	10
5	2,4	Viva-voce	10
Total Marks			100

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Manufacturing Technology-1By P.C Sharma of S. CHAND Publications.
2	Elements of Workshop Technology Vol-I Manufacturing Process edition-ByHajraChoudry
3	Elements of Workshop TechnologyVol-II Manufacturing Process edition-ByHajraChoudry
4	Work shop technology By R. S KHURMI &J. K GUPTA of S. CHAND&Co.Ltd
5	Welding processes and technology – O.P Khanna
6	Manufacturing Technology: Foundry Forming and Welding, P.N.Rao 2nd Edition TMH
7	Welding and Welding technology, Richard L little, Mc. Graw Hill Education

8. SEE Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1,3	<p>Identify the safety tools used for performing different metal fabrication processes/sheet metal operation/drilling operation. – 10m</p> <p>Identify the appropriate metal to be used, appropriate welding method and the right electrodes to be used for a given component/draft. -10m</p> <p>Or</p> <p>One question on “Defects in Welding/ press work operation/brazing”</p> <p>a) Identification of defects/ press work operation/brazing -10 m</p> <p>b) Remedy/ procedure followed before brazing 10 m</p>	20
2	2	<p>One skill-based question on “Welding/ Lathe/ Sheet Metal operation/ Casting/ Forging/ Drilling operation”.</p> <p>a) Safety methods followed -10m</p> <p>b) Performance of the Operation - 30 m</p> <p>c) Accuracy - 10 m</p>	50
4	1,2,3,4	Portfolio evaluation of practical session (1-13)	10
5	1,2,3,4	Viva-voce	20
Total Marks			100

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Arc welding transformer upto 300Amps with attachments and welding shields.		2
2	Gas welding machine with attachments and oxygen and acetylene cylinders.		2
3	Gas welding and gas cutting torches.		2
4	Electric furnace.		2
5	Spot welding machine with attachments.		1
6	Riveting machine		2
7	Sheet metal embossing machine.		2

8	Molding boxes.		2
9	Rammers.		2
10	Flatteners.		2
11	Trowels.		2
12	Strike off bar.		2
13	Shovels.		2
14	Open hearth furnace.		2
15	Anvil.		2
16	Swage block.		2
17	Flat and round tongs.		2
18	Bench vice.		2
19	Portable vertical drilling machine.		2
20	Lathe machine with attachments		5