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| Program : <b>Diploma in Automobile Engineering</b> |   |
| Course Code : <b>3052</b>                          | Course Title: <b>Manufacturing Technology for Automobile Components</b> |
| Semester : <b>3</b>                                | Credits: <b>3</b>   |
| Course Category: <b>Program Core</b>               |   |
| Periods per week: <b>3 (L:2, T:1, P:0)</b>         | Periods per semester: <b>45</b>   |

### Course Objectives:

- To provide a basic knowledge on metal casting and fabrication processes.
- To acquire knowledge of machine tools for specific applications, metal forming, additive manufacturing and their applications.

### Course Pre-requisites:

| Topic  | Course code | Course Title                  | Semester |
|--|-------------|-------------------------------|----------|
| Basic knowledge in general workshop practices. |             | Engineering workshop Practice | 2        |

### Course Outcomes

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

| CO <sub>n</sub> | Description   | Duration (Hours) | Cognitive level |
|-----------------|---|------------------|-----------------|
| CO1             | Choose metal casting and powder metallurgy.   | 12               | Applying        |
| CO2             | Classify sheet metal works used in automobile manufacturing and relate a fabrication process for specific automobile application.                     | 11               | Understanding   |
| CO3             | Demonstrate the working of standard machine tools such as lathe, shaping, milling, drilling machines and the basics of flexible manufacturing system. | 11               | Understanding   |
| CO4             | Outline the application of forging, rolling and additive manufacturing techniques in automobile industry.   | 9                | Understanding   |
|                 | Series Test   | 2                |                 |

**CO-PO Mapping:**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1             | 2   |     |     |     |     |     |     |
| CO2             | 3   |     |     |     |     |     |     |
| CO3             | 2   |     |     |     |     |     |     |
| CO4             | 2   |     |     |     |     |     |     |

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

**Course Outline:**

| Module Outcomes | Description   | Duration (Hours) | Cognitive Level |
|-----------------|---|------------------|-----------------|
| CO1             | <b>Choose metal casting and powder metallurgy.</b>  |                  |                 |
| M1.01           | Recall casting and pattern.   | 1                | Remembering     |
| M1.02           | Outline the requirements of a pattern material and list different types of pattern materials.   | 1                | Understanding   |
| M1.03           | Classify patterns like single, split, loose piece and sweep pattern.  | 1                | Understanding   |
| M1.04           | Define pattern allowance and define pattern allowances such as shrinkage, machining, draft, distortion, shake allowances.               | 1                | Understanding   |
| M1.05           | Define mould, cope, drag, runner, riser, core and chaplets.   | 1                | Understanding   |
| M1.06           | Distinguish green sand moulding and dry sand moulding and identify automotive components made by these processes.                       | 1                | Applying        |
| M1.07           | Explain hot chamber die casting, cold chamber die casting, centrifugal casting and identify automotive components made these processes. | 1                | Applying        |
| M1.08           | Define various casting defects.   | 1                | Understanding   |
| M1.09           | Define powder metallurgy and classify its merits and demerits .   | 1                | Understanding   |
| M1.10           | Illustrate the methods for making of metal powders such as atomization, reduction, electrolysis and spotting.                           | 1                | Understanding   |
| M1.11           | Outline various steps and secondary operations in powder metallurgy process.  | 1                | Understanding   |
| M1.12           | Identify automobile components made by powder metallurgy.   | 1                | Applying        |

**Contents:****Materials For Automobiles And Metal Casting**

Introduction to metal castings and patterns, pattern materials, types of patterns-single, split, loose piece, sweep, pattern allowances such as shrinkage, machining, draft, distortion, shake allowances.

Moulding terminology such as cope, drag, runner, riser, core and chaplets. Definition green sand and dry sand moulding, permanent mould casting such as hot chamber and cold chamber die casting and centrifugal casting and identify automotive components made these processes. Discuss various casting defects.

Powder metallurgy steps, secondary operations. Name the automotive components made by powder metallurgy, merits and demerits of powder metallurgy.

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|------------|---|---|---------------|
| <b>CO2</b> | <b>Classify sheet metal works used in Automobile field and relate a particular fabrication process for specific automobile application.</b>                   |   |               |
| M2.01      | Define sheet metal and identify the areas of application of sheet metal in automobile.  | 1 | Understanding |
| M2.02      | List metals used for sheet metal work and standard gauge numbers used for sheet metals.   | 1 | Understanding |
| M2.03      | Define various sheet metal operations like - shearing, cutting off, parting, blanking, punching, notching, slitting, lancing, bending, drawing and squeezing. | 1 | Understanding |
| M2.04      | Define welding and weldability.   | 1 | Remembering   |
| M2.05      | Explain the features of welding and general classification of welding.  | 1 | Understanding |
| M2.06      | List the equipment used in arc welding and discuss the arc welding principle.   | 1 | Understanding |
| M2.07      | Outline MIG Welding, TIG Welding and Submerged arc welding.   | 1 | Understanding |
| M2.08      | List equipment for gas welding and gas cutting.   | 1 | Understanding |
| M2.09      | Illustrate oxy-acetylene welding and types of flames.   | 1 | Understanding |
| M2.10      | Explain resistance welding such as – spot, butt, seam welding.  | 1 | Understanding |
| M2.11      | Comparesoldering and brazing.   | 1 | Understanding |
|            | Series Test – I   | 1 |               |

**Contents:****Sheet Metal And Fabrication Processes**

Introduction to Sheet Metal Work and Applications, metals used for Sheet Metal work, Standard Gauge numbers. Sheet metal operations-shearing, cutting off, Parting, blanking, Punching, notching, slitting, Lancing, Bending, Drawing and squeezing.

Introduction to Welding - Classification of welding such as fusion welding and solid state welding. - Arc welding principle and equipment, Types of Arc welding - MIG Welding, TIG Welding, Submerged arc welding. Equipment for Gas welding and gas cutting. Oxy - acetylene welding and Types of flames. Principle of resistance welding - Spot, butt, seam Welding.

Comparison of soldering and Brazing.

|            |  |   |               |
|------------|--|---|---------------|
| <b>CO3</b> | <b>Demonstrate the working of standard machine tools like lathe, shaping, milling, drilling machine and the basics of flexible manufacturing system.</b> |   |               |
| M3.01      | Identify the components of a lathe and define their functions, working and lathe specifications.   | 2 | Understanding |
| M3.02      | Define various lathe operations such as facing, centering, drilling, plain turning, boring, reaming, chamfering taper turning and thread cutting.        | 1 | Understanding |
| M3.03      | Identify the components of a of shaper and demonstrate the crank and slotted lever type quick return motion mechanism.                                   | 1 | Understanding |
| M3.04      | Identify the components of a drilling machine.   | 1 | Understanding |
| M3.05      | Define drilling, reaming and boring.   | 1 | Understanding |
| M3.06      | Identify the components of a Column and knee type milling machine.   | 2 | Understanding |
| M3.07      | Define plain milling, side milling, face milling, angle milling, end milling.  | 1 | Understanding |
| M3.08      | Identify the components of a CNC machine.  | 1 | Understanding |
| M3.09      | Outline the Flexible manufacturing system and relate its applications.   | 1 | Understanding |

**Contents:****Machine Tools And Operations**

Lathe - constructional features and working, various lathe operations such as facing, centering, drilling, plain turning, boring, reaming, chamfering taper turning and thread cutting. - Shaper - constructional features and working of the crank and slotted lever type

quick return motion mechanism - constructional features of a drilling machine. Hole making operations - drilling - reaming - boring. Milling - Column and knee type milling machine - various operations performed on milling machine.

Constructional features of CNC machines, illustrate flexible manufacturing system and its applications.

|             |  |   |               |
|-------------|--|---|---------------|
| <b>CO4:</b> | <b>Outline the application of forging, rolling and additive manufacturing techniques in automobile industry.</b>                               |   |               |
| M4.01       | Summarize hot working, cold working and the general classification of metal forming operations.  | 1 | Understanding |
| M4.02       | Define forging.  | 1 | Understanding |
| M4.03       | Define forging, smith forging and machine forging  | 1 | Understanding |
| M4.04       | Demonstrate the machine forging of crank shaft and connecting rod.   | 1 | Understanding |
| M4.05       | Illustrate rolling and rolling mill configurations.  | 1 | Understanding |
| M4.06       | Define direct extrusion, indirect extrusion, hot extrusion, cold extrusion, continuous extrusion, discrete extrusion and hydrostatic extrusion | 1 | Understanding |
| M4.07       | Define wire drawing and tube drawing.  | 1 | Understanding |
| M4.08       | Define hydroforming and shot peening.  | 1 | Understanding |
| M4.09       | Summarize the fundamentals, applications, classifications of additive manufacturing and define rapid prototyping.                              | 1 | Understanding |
|             | Series Test – II   | 1 |               |

### **Contents**

#### **Metal Forming And Powder Metallurgy**

Hot working, cold working and classification of metal forming operations. Forging- smith forging and machine forging. Machine forging of crank shaft and connecting rod.

Rolling and rolling mill configurations.

direct extrusion, indirect extrusion, hot extrusion, cold extrusion, continuous extrusion, discrete extrusion, hydrostatic extrusion. Wire drawing, tube drawing, hydroforming, shot peening,

Fundamentals, classifications and applications of additive manufacturing and rapid Prototyping.

**Text / Reference:**

| <b>T/R</b> | <b>Book Title/Author</b>  |
|------------|---|
| T1         | <i>Elements of Workshop Technology</i> Vol-I Manufacturing Process edition-By Hajra Choudry.                  |
| T2         | <i>Elements of Workshop Technology</i> Vol-II Manufacturing Process edition-By Hajra Choudry                  |
| R1         | <i>Work shop technology</i> By R.S KHURMI & J.K GUPTA of S.CHAND &Co. Ltd                                     |
| R2         | <i>Manufacturing Engineering and Technology</i> by Seropekalkpakjian, Steven R Schmid Pearson Education-Delhi |
| R3         | Manufacturing Technology-1By P.C Sharma of S.CHAND Publications.  |
| R4         | <i>Engineering Materials</i> by Er. R.K.RAJPUT of S.CHAND Publications  |

**Online Resources:**

| <b>Sl.No</b> | <b>Website Link</b>   |
|--------------|---|
| 1            | <a href="http://www.nptel.ac.in/courses/112105126/36">www.nptel.ac.in/courses/112105126/36</a>      |
| 2            | <a href="http://www.youtube.com/watch?v=T5gjkYvMg8A">www.youtube.com/watch?v=T5gjkYvMg8A</a>        |
| 3            | <a href="http://www.youtube.com/watch?v=TeBX6cKKHWY">http://www.youtube.com/watch?v=TeBX6cKKHWY</a> |