**DR.BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,**
**CHHATRAPATI SAMBHAJINAGAR.**

**CIRCULAR NO. SU/ Sci & Tech./B.Voc/ NEP/32/2026**

It is hereby inform to all concerned that, the Revised syllabi prepared by the Ad-hoc Board and recommended by the Dean, Faculty of Science & Technology **Academic Council at its meeting held on 22 December, 2025 has accepted the following New syllabi of Bachelor of Vocation under the Faculty of Science & Technology as per National Education Policy -2020 run at the University Department, Dr. Babasaheb Ambedkar Marathwada University as appended herewith.**

| Sr.No | Subject Name | Semester |
|---|---|---|
| 1. | **B.Voc in Industrial Automation (Industry Embedded) (New)** | **III & VI** |
| 2. | **B.Voc in Automobile (Industry Embedded) (New)** | **III & VI** |

This is effective from the Academic Year 2025-26 onwards under the Faculty of Science & Technology.

All concerned are requested to note the contents of the circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus,
Chhatrapati Sambhajinagar-431004.
Ref. No. S .U/Sci & Tech/B.Voc./2025-26/ 2575-78
Date: 02/ 01/ 2026

**Registrar,**

*******

**Copy forwarded and Information to necessary action:-**

1] **The Director, Department, of, Deen Dayal Upadhyay Kaushal Kendra, Dr. Babasaheb Ambedkar Marathwada University.**

2] **The Director, Board of Examination & Evaluation,**

3] **The Director,** University Network & Information Centre, UNIC, with a **request to upload this circular on University Website.**
Dr. Babasaheb Ambedkar Marathwada University **Chhatrapati Sambhajinagar.**

# Dr. Babasaheb Ambedkar Marathwada University,
## Chhatrapati Sambhajinagar – 431 004 (MS), India
## Deen Dayal Upadhyay KAUSHAL Kendra (DDUKK)

**Dr.Bharti W. Gawali**
M.Sc., Ph.D., SET in Computer Science
**Director**

"NAAC Reaccredited with 'A+' Grade"

**Phone No : +91-240-3266 (30)/2403386**
**Fax No : +91-240-2403113**
**Cell : +91-9404012032,**
**Email : director.ddukk@bamu.ac.in**


**Ref No: DDUKK/2025-26/ 190A** **Date: 14/11/2025**

**To,**
**The Deputy Registrar,**
**Syllabus Section,**
**Dr. Babasaheb Ambedkar Marathwada University,**
**Chh. Sambhajinagar (MS) – 431004**

**SUB: Submission of 3rd & 4th semester syllabi of the subjects of Industrial Automation and Automobile (Industry Embedded) and Automobile of Deen Dayal Upadhyay KAUSHAL Kendra (DDUKK) for approval purpose.**

**Dear Sir,**

With reference to above ciated subject, it is hereby submitted that syllabi of the subjects of Industrial Automation and Automobile (Industry Embedded) and Automobile of Deen Dayal Upadhyay KAUSHAL Kendra (DDUKK) for approval have been submitted to the syllabus section. Hence it is now requested to kindly approve the syllabi and do the needful.

I am looking forward to have your esteemed co-operation,

Thanking you with utter anticipation,

Thanking You,

Best Regards,

**Director**
**Deen Dayal Upadhyay KAUSHAL Kendra (DDUKK)**

Director
Deen Dayal Upadhyay Kaushal Kendra,
Dr. Babasaheb Ambedkar
Marathwada University,
Chhatrapati Sambhajinagar(MS)-431004.

**Encl.** – as above

Dr. Babasaheb Ambedkar Marathwada University
Inward
Syllabus Section
03/12/25
Aurangabad

o/c total pgs 30
DD 218585
TD 98909

# Dr. Babasaheb Ambedkar Marathwada University

## Chhatrapati Sambhajinagar- 431001

## B.VOC. Degree Program

(Three Year)

SEMESTER-III

# DDU KAUSHAL Kendra
# Automobile Division

## (Revised)

(AS PER NEP-2020)

## Subject (Major): Automobile (Industry Embedded)

## Effective from 2025-26

## B.VOC. Second Year: 3rd Semester

Students will have to select / declare choice of **one major subject** and **one minor subject** from three major options M1, M2 and M3 (which were opted in the first year)

| Course Type | Course Code | Course Name | Teaching Scheme (Hours / Week) | | Credits Assigned | | Total Credits |
|---|---|---|---|---|---|---|---|
| | | | Theory | Practical | Theory | Practical | |
| Major (Core) Mandatory | AU(IE)/DSC/T/200 | Automobile Transmission | 2 | | 2 | | 2+2+2+2 = 08 |
| | AU(IE)/DSC/T/201 | Hydraulics and Pneumatics | 2 | | 2 | | |
| | AU(IE)/DSC/P/226 | Practical based on AU/DSC/T/200 | | 4 | | 2 | |
| | AU(IE)/DSC/P/227 | Practical based on AU/DSC/T/201 | | 4 | | 2 | |
| Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty** | Mn-1 | To be chosen from other discipline of same faculty | 4 | | 4 | | 04 |
| Generic / Open Elective ( GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major** | AU(IE)/GE/OE /T/200 | To be chosen from other faculty | 2 | | 2 | | 02 |
| **VSC** ( Vocational Skill Courses) (Choose any one from pool of courses) | AU(IE)/VSC/T/200 | Manufacturing Processes | 1 | | 1 | | 1+1 =02 |
| | AU(IE)/VSC/T/201 | Electric Motors | 1 | | 1 | | |
| | AU(IE)/VSC/P/226 | Practical based on AU/VSC/T/200 | | 2 | | 1 | |
| | AU(IE)/VSC/P/227 | Practical based on AU/VSC/T/201 | | 2 | | 1 | |
| AEC, VEC, IKS | AU(IE)/AEC/T/200 | English ( Common for all the faculty) | 2 | | 2 | | 02 |
| | AU(IE)/VEC/T/201 | Environmental Studies | 2 | | 2 | | 02 |
| OJT/ FP/CEP/CC/RP | CC-3 | Cultural Activity / NSS,NCC ( Common for all the faculty) | | 4 | | 2 | 02 |
| | | | **15** | **14** | **15** | **07** | **22** |

**Minor Courses for other Discipline**

AU(IE)/Mn/T/200 (Workshop Technology) and AU(IE)/Mn/T/201 (Engineering Drawing) are 2 courses of 2 credits each designed for other discipline.

**Generic /Open Elective Courses for other faculty**

AU(IE)/GE/OE/200 (Hydraulics and Pneumatics: 2 credit theory course to be designed for other faculty.

## B.VOC. Second Year: 4th Semester

| Course Type | Course Code | Course Name | Teaching Scheme ( Hrs / Week) | | Credits Assigned | | Total Credits |
|---|---|---|---|---|---|---|---|
| | | | Theory | Practical | Theory | Practical | |
| Major ( Core) Mandatory | AU(IE)/ DSC-17 | Electric & Hybrid Vehicles | 2 | | 2 | | 2+2+2+2 = 08 |
| | AU(IE)/ DSC-18 | Automotive HVAC | 2 | | 2 | | |
| | AU(IE)/ DSC-19 | Practical based on DSC-17 | | 4 | | 2 | |
| | AU(IE)/ DSC-20 | Practical based on DSC-18 | | 4 | | 2 | |
| Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty** | AU(IE)/Mn-2 | To be chosen from other discipline of same faculty | | | 4 | | 04 |
| Generic / Open Elective ( GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major** | AU(IE)/ GE/OE-4 | Motor Vehicle Act | 2 | | 2 | | 02 |
| **SEC** ( Skill Enhancement Courses) (Choose any one from pool of courses) | AU(IE)/SEC-3 | 1. Computer Aided Manufacturing 2,Automobile Sensors | 1 | | 1 | | 1+1 =02 |
| | AU(IE)/SEC-4 | Practical based on SEC-3 | | 2 | | 1 | |
| AEC, VEC, IKS | AU(IE)/AEC-4 | Modern Indian Language (MIL-2) ( Common for all the faculty) | 2 | | 2 | | 02 |
| OJT/ FP/CEP/CC/RP | AU(IE)/FP-1 | Field Project | | 4 | | 2 | 2+2= 04 |
| | CC-4 | (Fine/ Applied/ Visual/ Performing Arts) ( Common for all the faculty) | | 4 | | 2 | |
| | | | **13** | **18** | **13** | **09** | **22** |
| **Exit Option : Award of UG Diploma in major and minor with 88 credits and an additional 4 credits NSQF course ( related to major / minor) / Internship during summer vacation OR Continue with Major and Minor** | | | | | | | |

## Minor Courses for other Discipline

AU(IE)/Mn/T/250 (Automotive Materials) and AU(IE)/Mn/T/251 (Basic Electronics System) are 2 courses of 2 credits each designed for other discipline

**Generic /Open Elective Courses for other faculty**

AU/GE/OE/250 (Electric and Hybrid Vehicle): 2 credit theory course to be designed for other faculty.

## AU(IE)/DSC/T/200 Automobile Transmission

Total Credits : 02 Total Contact Hours : 30
Maximum Marks : 50

**Course Objectives:**
To introduce Student with Automobile Transmission System along with key important concepts of Manual, Automatic and Differential.

**Course Outcomes (CO):**
1. Identify the components of transmission system.
2. Demonstrate the functional requirement of automobile transmission
3. Explain working of Electronic Automatic Transmission

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | M | | | | | | | H | | |
| CO2 | M | H | M | | M | | | | M | M | |
| CO3 | | M | | M | | | | | M | H | M |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **Unit - I**<br><br>**Transmission Elements** | Introduction, Transmission gears, drive Shaft, Belt, Couplings, Pulley, Bearings, **Clutch**:- Necessity, Requirements of Clutch, Principle of friction Clutch, Types of Clutch - construction and working of Single plate Clutch, Multi plate clutch, Diaphragm Clutch, desirable properties of clutch material | **10 Hours** |
| **Unit- II Manual Transmission** | **Necessity of Gear box** in Automobile Transmission System, Functions of Gear box, Types of Gear box, Construction and Working - a) Sliding mesh Gearbox, b) Constant mesh Gearbox, c) Synchro- mesh Gearbox, Introduction to Manual Transaxle, Basic transaxle construction, Power flow through a transaxle, CV joints, Differential action | **10 Hours** |
| **Unit- III Automatic Transmission** | Automatic Transmission- necessity of automatic transmission, Construction and working of a) Torque Converter b) Overdrive Continuously Variable Transmission (CVT) - Principle, construction and working, advantages and disadvantages | **10 Hours** |

**References:**


1. Automotive Technology Manual Transmission, Jack Erjavec, Cengage Learning, ISBN-10: 81-315-1423-8, ISBN-13: 9788131514234
2. Automotive Mechanics: William H. Crouse. Donald L. Anglin: Tata McGraw Hill 10th edition ISBN: 9780070634350.
3. Basic Automobile Engineering: C P Nakara: Dhanpatrai publication ISBN-10:9352160983.
4. Automotive Mechanics: S Shrinivasan: Tata McGraw Hill Second edition ISBN10 8187433221.
5. Automobile engineering Vol-II: Dr. Kripal Singh: Standard Publisher distributers ISBN- 10: 818014196

## AU(IE)//DSC/T/201 : Hydraulics and Pneumatics

Total Credits: 02

Total Contact Hours: 30

Maximum Marks: 50

**Course Objectives:**

- To impart fundamental knowledge of hydraulic and pneumatic systems.
- To develop the ability to design and troubleshoot fluid power circuits.
- To understand fluid system components, ISO symbols, and safety practices.

Course Outcomes (CO):

| CO No. | Course Outcome Description |
|---|---|
| CO1 | Understand principles, advantages, and components of fluid power systems. |
| CO2 | Analyze and differentiate various hydraulic and pneumatic components and circuits. |
| CO3 | Design and simulate basic fluid power circuits for industrial applications. |

**CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | M | | | | | | | H | | |
| CO2 | M | H | M | | | | | | H | M | |
| CO3 | | M | H | H | H | | | | M | H | M |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **Unit I: Introduction to Fluid Power Systems** | • Basics: Hydraulics vs Pneumatics<br>• Applications, advantages, disadvantages<br>• Properties of fluids: Compressibility, viscosity, density<br>• Energy and power in fluid systems<br>• ISO and SAE grades of oil<br>• ISO symbols in hydraulic and pneumatic systems<br>• Safety and hazards in fluid systems<br>• Pascal's law, Bernoulli's principle (brief overview) | **10 Hours** |
| **Unit II: Pumps and Actuators** | • Classification and working of pumps: Gear, Vane, Screw, Piston (axial & radial)<br>• Pump performance curves, efficiency, cavitation<br>• Selection and maintenance of pumps | **10 Hours** |

| | | |
|---|---|---|
| | • Control valves: Directional, flow, pressure<br>• Actuators: Linear and rotary types<br>• Reservoirs, accumulators, filters, hoses, seals and fittings | |
| **Unit: -III Pneumatic System Components** | • Compressors: Reciprocating, rotary, screw types<br>• Air treatment: Filters, regulators, lubricators (FRL unit)<br>• Pneumatic actuators: Single/double-acting cylinders, telescopic, rotary<br>• Pneumatic valves: 2/2, 3/2, 5/2, 5/3 types<br>• Flow and pressure control valves<br>• Basic hydraulic circuits: Meter-in, meter-out, bleed-off<br>• Introduction to electro-pneumatics and logic valves | **10 Hours** |

**Reference Books:**


1. Andrew Parr, *Hydraulics and Pneumatics*, Elsevier/Newnes
2. S.R. Majumdar, *Pneumatic Systems*, Tata McGraw-Hill
3. Anthony Esposito, *Fluid Power with Applications*, Pearson Education
4. Jagadeesha T., *Introduction to Hydraulics and Pneumatics*, I.K. International
5. Herbert E. Merritt, *Hydraulic Control Systems*, Wiley
6. Pippenger & Hicks, *Industrial Hydraulics*, McGraw-Hill

## AU(IE)//VSC/T/200: Manufacturing Processes

Total Credits : 01 Total Contact Hours :15
Maximum Marks :25

**Course Objectives:** To provide students with a fundamental understanding of various conventional and non-conventional manufacturing processes, including sheet metal forming and cutting, and to equip them with the principles of tool & die making.

**Course Outcome (CO):**

1. Design and construction of jigs and fixtures for industrial applications.
2. Explain the working principle of non-conventional machining processes.
3. To identify the sheet metal operations.

**CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | | | | | | | | H | | |
| CO2 | | H | | M | | | | | | M | M |
| CO3 | | | M | | M | | | | M | | |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **Unit:-I Sheet Metal & Operations** | **Introduction to Sheet Metal:** Properties of sheet metal, Raw material information for common sheet metal. **Cutting Operations:** Shearing, Punching, Blanking and Trimming, Notching, Lancing **Forming Operations:** Bending, Drawing, Stamping, Stretch Forming, Metal Spinning: Deep Drawing | **4 Hours** |
| **Unit:-II Die and fixture** | **Introduction to Tool & Die Making**: role of press tools, jigs, and fixtures, their importance in manufacturing, and industry applications, Simple Die, Combination Die, Progressive Dies; Dies and Fixtures Design, Jigs and Fixtures Construction | **6 Hours** |
| **UNIT-III Non-Traditional Machining** | **Introduction to Non-Traditional Machining:** Need for NTM processes, Comparison with conventional machining. **Abrasive Jet Machining (AJM):** Principle of operation. **Ultrasonic Machining (USM):** Principle of operation, Applications. **Electrochemical Machining (ECM):** Principle of operation. Equipment and tooling. **Electrical Discharge Machining (EDM):** Principle of operation. Equipment and process parameters. Applications. **Laser Beam Machining (LBM):** Principle of operation. Equipment and mechanism of metal removal. Process parameters | **5 Hours** |

**References:**


1) Workshop Technology (Manufacturing Processes)" by R.S. Khurmi and J.K. Gupta
2) Manufacturing Processes" by J.P. Kaushish:
3) Manufacturing Processes" by P.N. Rao:
4) "A Textbook of Workshop Technology (Manufacturing Processes)" by R.S. Khurmi and J.K. Gupta

## AU(IE)//VSC/T/201: Electric Motor

Total Credits: 01 Total Contact Hours :15
Maximum Marks :25

**Course Objectives:** To provide a comprehensive understanding of the principles of operation, construction, characteristics, control, and applications of various types of DC, AC, and BLDC electric motors.

**Course Outcomes (CO):** After completion of course, student must be able to:

1. Select Motor for particular application
2. Demonstrate the construction and working principle of DC, AC, and BLDC motor.
3. Explain application and uses of Special Purpose Electric Motors.

**CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | | | | | | | | H | | |
| CO2 | | M | M | | H | | | | | M | |
| CO3 | | | | M | | | | | M | | M |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **Unit:-I DC Motors** | **DC Motors and Fundamentals of Electromechanical Energy Conversion**: Introduction to Electromechanical Energy Conversion: Basic principles, **DC Generators (Brief Review/Foundation for Motors):** Constructional features, **DC Motors: Principles and Characteristics:** Principle of operation: Torque production in a DC motor **Starting and Speed Control of DC Motors:** Necessity of starters for DC motors. | **5 Hours** |
| **Unit: -II AC Motors** | Three-Phase Induction Motors; Fundamentals; Constructional features: Stator, Rotor, Air gap. Principle of operation. Torque and Performance Characteristics of Three-Phase Induction Motors. Starting and Speed Control of Three-Phase Induction Motors. Single-Phase Induction Motors | **4 Hours** |
| **UNIT-III Special Motors** | **BLDC Motors and Other Special Purpose Motors Brushless DC (BLDC) Motors:** Introduction, Construction, Principle of operation, Driving methods for BLDC motors. **Stepper Motors:** Introduction to stepper motors: Principle of operation, Types, **Servo Motors:** Introduction to servo motors: Components Types: Principle of operation. **Other Special Purpose Motors** Reluctance Motors: Principle and applications. Hysteresis Motors: Principle and applications. Linear Induction Motors: Principle and applications. Switched Reluctance Motors (SRM), Universal Motor | **6 Hours** |

**References:**


1) Electrical Technology, Volume II: AC and DC Machines" by B.L. Theraja and A.K. Theraja:
2) Electrical Machines" by P.S. Bimbhra:
3) Electrical Machines" by D.P. Kothari and I.J. Nagrath

## AU(IE)//DSC/P/226 Practical Based on Automobile Transmission

Total Credits: 02
Maximum Marks: 50

Total Contact Hours: 30

**Course Outcomes (COs):**

After completion of the course, students will be able to -

I. Perform Trouble shooting of clutch assembly
II. Perform Trouble shooting of gearbox assembly

**CO-PO Attainment Matrix for Course**
**(L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | H | | | | | | | M | |
| CO2 | | | H | | | | | | M | | |

**List of Experiments (Any 6)**

*The List of Practical's for above course will be provide after commencement of program in consultation with Industry Experts.*

**AU(IE)//VSC/P/226 Practical Based on Manufacturing Processes**

Total Credits: 01
Maximum Marks: 25

Total Contact Hours: 30

**Course Outcomes (COs):**

- **After completion of the course, students will be able to –**

Apply foundational knowledge of engineering materials and conventional sheet metal and machining processes, coupled with principles of tool & die design and construction, to effectively analyze, select, and utilize appropriate manufacturing techniques, including non-traditional machining processes, for producing components in various industrial applications.

**CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | |
| CO2 | H | | | M | | | | | M | | |
| CO3 | | M | | | | | | | | M | |

## List of Practical

*The List of Practical's for above course will be provide after commencement of program in consultation with Industry Experts.*

## AU(IE)//DSC/P/227: Practical based on Hydraulics and Pneumatics

Total Credits: 02 Total Contact Hours: 60
Maximum Marks: 50

**Course Objectives:**

- To impart fundamental knowledge of hydraulic and pneumatic systems.
- To develop the ability to design and troubleshoot fluid power circuits.
- To understand fluid system components, ISO symbols, and safety practices.

Course Outcomes (CO):

| CO No. | Course Outcome Description |
|---|---|
| CO1 | Understand principles, advantages, and components of fluid power systems. |
| CO2 | Analyze and differentiate various hydraulic and pneumatic components and circuits. |
| CO3 | Design and simulate basic fluid power circuits for industrial applications. |

**CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | M | | | | | | | H | | |
| CO2 | M | H | M | | | | | | H | M | |
| CO3 | | M | H | H | H | | | | M | H | M |

**List of Practical:**

*The List of Practical's for above course will be provide after commencement of program in consultation with Industry Experts.*

**AU(IE)//VSC/P/227 Practical Based on Electric Motor**

Total Credits: 01
Maximum Marks: 25

Total Contact Hours: 30

**Course Outcomes (COs):**

- **After completion of the course, students will be able to –**

  Analyze and explain the fundamental principles of electromechanical energy conversion and apply them to understand the operation, characteristics, and control of various DC, AC (Induction and Synchronous), BLDC, and other special purpose motors, enabling them to select and apply appropriate motor types for diverse engineering applications.

**CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | | | | | | | | H | | |
| CO2 | H | | M | | | | | | | M | |
| CO3 | | H | | | M | | | | M | | |

## List of Practical

*The List of Practical's for above course will be provide after commencement of program in consultation with Industry Experts.*

## AU(IE)/Mn/T/200 : Workshop Technology

Total Credits : 02
Maximum Marks : 50

Total Contact Hours : 30 Hrs

**Learning Objectives of the Course:**

To introduce students with basic automobile concepts like

i. Four stroke engines,
ii. Engine lubrication system,
iii. Engine cooling system,
iv. Fuel injection system and ignition systems

**Course Outcomes ( COs) :**

After completion of the course, students will be able to -

**i)** Explain Manufacturing Machines used in automobile workshop.
**ii)** Recommend Machines and manufacturing process for different automotive components.

**CO-PO Attainment Matrix for Course**
**(L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | | | | | | | | | | |
| CO 2 | H | | | | | | | | | | |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Forming and Metal Joining Methods:** Drop forging: open die & closed die forging, forging operations. Rolling: Principle of rolling, hot & cold rolling, Extrusion: Direct & indirect extrusion. Gas welding, carbon arc welding, shielded metal arc welding, TIG welding, MIG welding, plasma arc welding, resistance welding types spot, seam projection. Electron beam welding, laser beam welding, Soldering and Brazing | **10 Hrs** |
| II | **Casting Processes:** Pattern making: Basic steps in making casting, Pattern: types, materials and allowances, Moulding: Types of moulding sands, properties of sand, moulding methods, cores and core prints, elements of gating system, Casting: Furnaces: Construction and working of cupola furnace, Centrifugal casting, shell moulding, investment casting, Casting defects - Causes & remedies | **10 Hrs** |
| III | **Machining Operations:** Lathe Machine: Introduction, classification and basic parts of center lathe & their functions, Lathe operations like facing, plain turning, taper turning, thread cutting, chamfering, grooving, knurling. Cutting tool nomenclature & tool signature, Drilling Machine Introduction, classification, basic parts of radial drilling machine and their functions, twist drill nomenclature, drilling machine operations like drilling, reaming, boring, counter sinking, counter boring, spot facing. Cutting parameters. | **10 Hrs** |

## AU(IE)/Mn/T/200 : Workshop Technology

Total Credits : 02
Maximum Marks : 50

Total Contact Hours : 30 Hrs

**Learning Objectives of the Course:**

To introduce students with basic automobile concepts like

i. Four stroke engines,
ii. Engine lubrication system,
iii. Engine cooling system,
iv. Fuel injection system and ignition systems

**Course Outcomes ( COs) :**

After completion of the course, students will be able to -

**i)** Explain Manufacturing Machines used in automobile workshop.
**ii)** Recommend Machines and manufacturing process for different automotive components.

**CO-PO Attainment Matrix for Course**
**(L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | | | | | | | | | | |
| CO 2 | H | | | | | | | | | | |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| I | **Forming and Metal Joining Methods:** Drop forging: open die & closed die forging, forging operations. Rolling: Principle of rolling, hot & cold rolling, Extrusion: Direct & indirect extrusion. Gas welding, carbon arc welding, shielded metal arc welding, TIG welding, MIG welding, plasma arc welding, resistance welding types spot, seam projection. Electron beam welding, laser beam welding, Soldering and Brazing | **10 Hrs** |
| II | **Casting Processes:** Pattern making: Basic steps in making casting, Pattern: types, materials and allowances, Moulding: Types of moulding sands, properties of sand, moulding methods, cores and core prints, elements of gating system, Casting: Furnaces: Construction and working of cupola furnace, Centrifugal casting, shell moulding, investment casting, Casting defects - Causes & remedies | **10 Hrs** |
| III | **Machining Operations:** Lathe Machine: Introduction, classification and basic parts of center lathe & their functions, Lathe operations like facing, plain turning, taper turning, thread cutting, chamfering, grooving, knurling. Cutting tool nomenclature & tool signature, Drilling Machine Introduction, classification, basic parts of radial drilling machine and their functions, twist drill nomenclature, drilling machine operations like drilling, reaming, boring, counter sinking, counter boring, spot facing, Cutting parameters. | **10 Hrs** |

***Text Books:***

1. B. S. Raghuwanshi. "Workshop Technology" Vol-I & Vol-II: Dhanpat Rai& Co.
2. S. K. Hajra Choudhari. A. K. Hajra Choudhari, "Workshop Technology Vol-I and Vol-II": Nirjhar Roy :Media Promoters and Publication Pvt.Ltd
3. W.A.J. Chapman, "Workshop Technology Vol-III":

***Website Links:***

1. https://www.youtube.com/watch?v=jdFrBtHeJbs&list=PLtAjRFb9nXmzRwSuuYmUoIxIQOu5ccdM_&ab_channel=Fundamentalsofmanufacturingprocesses

***NPTEL/SWAYAM Courses:***

1. Fundamentals of manufacturing processes

# Dr. Babasaheb Ambedkar Marathwada University

## Chhatrapati Sambhajinagar- 431004

## B.VOC. Automobile (Industry Embedded) Degree Program

**(Three Year)**

**SEMESTER-IV**

# DDU KAUSHAL Kendra

## Automobile Division

## (Revised)

**(AS PER NEP-2020)**

## Subject (Major): Automobile

**Effective from 2025-26**

## B.VOC. Second Year: 4th Semester

| Course Type | Course Code | Course Name | Teaching Scheme ( Hrs / Week) | | Credits Assigned | | Total Credits |
|---|---|---|---|---|---|---|---|
| | | | Theory | Practical | Theory | Practical | |
| Major ( Core) Mandatory | DSC-17 | Electric & Hybrid Vehicles | 2 | | 2 | | 2+2+2+2 = 08 |
| | DSC-18 | Automotive HVAC | 2 | | 2 | | |
| | DSC-19 | Practical based on DSC-17 | | 4 | | 2 | |
| | DSC-20 | Practical based on DSC-18 | | 4 | | 2 | |
| Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty** | Mn-2 | To be chosen from other discipline of same faculty | | | 4 | | 04 |
| Generic / Open Elective ( GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major** | GE/OE-4 | Motor Vehicle Act | 2 | | 2 | | 02 |
| **SEC** ( Skill Enhancement Courses) (Choose any one from pool of courses) | SEC-3 | 1. Computer Aided Manufacturing 2,Automobile Sensors | 1 | | 1 | | 1+1 =02 |
| | SEC-4 | Practical based on SEC-3 | | 2 | | 1 | |
| AEC, VEC, IKS | AEC-4 | Modern Indian Language (MIL-2) ( Common for all the faculty) | 2 | | 2 | | 02 |
| OJT/ FP/CEP/CC/RP | FP-1 | Field Project | | 4 | | 2 | 2+2= 04 |
| | CC-4 | (Fine/ Applied/ Visual/ Performing Arts) ( Common for all the faculty) | | 4 | | 2 | |
| | | | **13** | **18** | **13** | **09** | **22** |
| **Exit Option : Award of UG Diploma in major and minor with 88 credits and an additional 4 credits NSQF course ( related to major / minor) / Internship during summer vacation OR Continue with Major and Minor** | | | | | | | |

## Minor Courses for other Discipline

AU/Mn/T/250 (Automotive Materials) and AU/Mn/T/251 (Basic Electronics System) are 2 courses of 2 credits each designed for other discipline

**Generic /Open Elective Courses for other faculty**

AU/GE/OE/250 (Electric and Hybrid Vehicle): 2 credit theory course to be designed for other faculty.

## DSC 17 Electric & Hybrid Vehicles

Total Credits: 02 Total Contact Hours: 30
Maximum Marks: 50

**Course Objectives:**

- To understand general aspects of Electric and Hybrid Vehicles.
- To select the suitable electric propulsion systems
- To select required energy storage and charging devices

**Course Outcomes (CO):**

1. Summarize the general aspects of Electric and Hybrid Vehicles (EHV).
2. Identify the various types of motors used in electric vehicles
3. Select the required energy storage and charging devices for Electric and Hybrid vehicles.

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | M | | | | | | | H | | |
| CO2 | M | H | M | | M | | | | M | M | |
| CO3 | | M | | M | | | | | M | H | M |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **Unit - I**<br>**Introduction to Electric Vehicle** | History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, Classification of EV. Architecture of HEV: Series HEV, Parallel HEV and Series-Parallel HEV, Government Schemes and Progress: FAME-1, FAME-2 | **10 Hours** |
| **Unit- II**<br>**Motor drive Technologies:** | Electric propulsion unit - Classification of EV Motors, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switched reluctance motor dives | **10 Hours** |
| **Unit- III**<br>**Energy storage requirements** | Definition of various Battery Parameters. Different types of batteries – Lead Acid, Nickel-based, Sodium based, Lithium based, Metal Air based. Battery charging, Quick Charging devices. Battery Management System, Battery charging technologies: Methods of battery charging –Onboard and offboard charging | **10 Hours** |

**References:**


1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC, 2004. ISBN 0-8493-3154-4
3. Iqbal Hussein, "Electric and Hybrid Vehicles Design Fundamentals", CRC Press. , 2003 ISBN 0203009398, 9780203009390
4. Jack Erjavec, Jeff Arias, "Hybrid, Electric and Fuel-cell Vehicles", Cengage Learning India Pvt Ltd. New Delhi.


**Web Resources:**

https://nptel.ac.in/courses/108/103/108103009/
https://nptel.ac.in/courses/108/106/108106170

## DSC 18 Automotive HVAC

Total Credits : 02

Total Contact Hours: 30 Hrs

Maximum Marks : 50

**Course Objectives:**

- To provide fundamental knowledge of automotive heating, ventilation, and air conditioning systems.
- To understand refrigerants, HVAC components, and automatic climate control.
- To develop ability for inspection, troubleshooting, and safe servicing of automotive HVAC systems.

**Course Outcomes (CO):**

| CO No. | Course Outcome Description |
|---|---|
| CO1 | Understand basic principles and elements of automotive HVAC systems. |
| CO2 | Identify, analyze and troubleshoot automotive cooling & heating system components |
| CO3 | Apply maintenance and servicing procedures with safety in automotive HVAC. |

**CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)**

| Course Outcomes | PO 1 | PO 2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO 1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | L | L | L | L | L | L | L | M |
| CO2 | L | L | L | M | L | L | M | — | M | L |
| CO3 | M | M | M | L | M | L | M | — | L | M |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **Unit I: Fundamentals of Automotive Air Conditioning Systems** | • Requirement of A/C in vehicles<br>• Refrigeration load, cooling capacity & ton of refrigeration<br>• DBT, WBT, Dew point, humidity and RH<br>• Latent heat of condensation & evaporation<br>• Heat transfer modes<br>• Moist / saturated / unsaturated air<br>• Refrigerants & oils: types, properties<br>• Environmental effects & eco-friendly refrigerants<br>• Basic HVAC terminology | **10 Hrs** |
| **Unit II: Cooling, Heating & Ventilation Systems** | • Automotive cooling cycle<br>• Components: Magnetic clutch, Compressors, Condenser, Receiver drier, Accumulator, Expansion valve, Orifice tube, | **10 Hrs** |

| | | |
|---|---|---|
| | Evaporator<br>• Troubleshooting of cooling system<br>• Heating system working cycle<br>• Heating system construction & components<br>• Electric heating system<br>• Ventilation system components & functions<br>• Types of automotive A/C units<br>• Troubleshooting of heating system | |
| **Unit: -III HVAC Controls, Climate Control & Servicing** | • Manual / automatic HVAC controls<br>• Semi-automatic temperature controls & sensors<br>• Automatic climate control systems<br>• Safe handling practices<br>• HVAC inspections & testing<br>• Leak detection techniques<br>• Refrigerant charging / discharging<br>• Servicing of compressor, evaporator, condenser, heater core & hoses | **10 Hrs** |

**Reference Books:**

1. Automotive Air Conditioning and Climate control Systems. Steven Daly Butterworth-Heinemann publications.
2. Automobile Engineering (Volume – VI) Anil Chhikara Satya Prakashan.
3. Automotive Airconditioning William H. Carouse & Donald L. Anglin Tata McGraw-Hill Co., Ltd., New Delhi.
4. Automotive heating and air conditioning Mark Schnubel Cengage Publication.

**List of Open-Source Software/learning website:**

1. https://www.howacarworks.com
2. https://swayam.gov.in
3. http://nptel.ac.in/courses/112105129/pdf/R&AC
4. https://tinyurl.com/57mv2hct for video link
5. https://tinyurl.com/yysu44b6 for web link

**DSC20 Practical based on Automotive HVAC**

Total Credits : 02

Total Contact Hours : 60 Hrs

Maximum Marks : 50

*The List of Practical's for above course will be provide after commencement of program in consultation with Industry Experts.*

**DSC 19 Practical Based on Electric and Hybrid Vehicles**

Total Credits: 02 Total Contact Hours: 60
Maximum Marks: 50

*The List of Practical's for above course will be provide after commencement of program in consultation with Industry Experts.*

## SEC/Elective 1 : Computer Aided Manufacturing (CAM)

Total Credit: 01 Total Contact Hours: 15 Hrs

Maximum Marks: 50

**Course Objectives:**

- To impart understanding of CNC machine tools and control systems
- To introduce part programming using G & M codes
- To enable components machining using CNC Turning and Milling
- To familiarize students with CAM software and manufacturing automation

**Course Outcomes (CO):**

| CO No. | Course Outcome Description |
|---|---|
| CO1 | Understand CNC machine structure, working, and control systems. |
| CO2 | Develop CNC part programs using G/M codes for turning and milling. |
| CO3 | Apply CAM tools for toolpath generation and machining simulations. |

**CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | M | L | — | — | L | — | H | M | — |
| CO2 | M | H | M | M | M | L | — | H | H | — |
| CO3 | L | M | H | H | H | M | — | M | H | M |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **Unit 1: CNC Machine Tools & Control Systems** | • Introduction to CAD–CAM integration<br>• Construction & working of CNC turning and machining centers<br>• Axes convention, drives and feedback systems<br>• CNC controller functions and interfacing<br>• Tooling systems and work holding devices<br>• Advantages of CNC in modern manufacturing | **10 Hrs** |
| **Unit 2: CNC Programming for Turning & Milling** | • Overview of part programming<br>• Coordinate systems & preparatory (G) & miscellaneous (M) codes<br>• Programming for:<br>– CNC turning operations (facing, turning, threading, taper, grooving)<br>– CNC milling operations (pocketing, contouring, drilling cycles)<br>• Canned cycles and subprograms | **10 Hrs** |

| | | |
|---|---|---|
| | • Tool offset and tool radius compensation | |
| **Unit 3: CAM Software & Process Automation** | • Introduction to CAM environment & tool libraries<br>• 2D and 3D toolpath generation concepts<br>• CNC simulation and post-processing<br>• Flexible Manufacturing Systems (FMS)<br>• Introduction to Robotics & AGV in manufacturing<br>• Industry 4.0 and smart manufacturing overview | **10 Hrs** |
| | | |

**Reference Books:**


1. Mikell P. Groover — Automation, Production Systems & CIM
2. P.N. Rao — CAD/CAM
3. James Madison — CNC Machining Handbook
4. Y. Koren — Computer Control of Manufacturing Systems
5. Kundra & Rao — Numerical Control and CAM

**SEC/P/Elective 1: Practical Based on Computer Aided Manufacturing (CAM)**

Total Credit : 01

Total Contact Hours : 30 Hrs

Maximum Marks : 50

*The List of Practical's for above course will be provide after commencement of program in consultation with Industry Experts.*

## SEC/Elective 2 : Automobile Sensors

Total Credit: 01 Total Contact Hours: 30
Maximum Marks: 50

**Course Objectives:**

- To provide an over view of the concepts involved automotive sensors technology.

**Course Outcomes (CO):**

1. Discuss the basics of various Power train sensors and chassis management associated systems for proper vehicle dynamics and stability in automotive systems.
2. Comprehend various sensors for vehicle body management

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | M | | | | | | | H | | |
| CO2 | M | H | M | | M | | | | M | M | |
| CO3 | | M | | M | | | | | M | H | M |

| Module No. | Topics / actual contents of the syllabus | Contact Hours |
|---|---|---|
| **Unit - I**<br><br>**Powertrain Sensors and Chassis Management** | Engine combustion sensing, exhaust temperature sensor, NOx sensor, fuel quality sensor, level sensor, torque sensor, mass flow sensor, manifold absolute pressure sensor. Wheel speed sensors/direction sensors, steering position sensor, acceleration sensor, brake pneumatic pressure sensor, ABS sensor, electronic stability sensor | **5 Hours** |
| **Unit- II**<br>**Sensors for vehicle body & Convenience** | Adaptive cruise Control, air bag sensor, key less entering sensor. Tire pressure monitoring systems, Two wheeler and Four wheeler security systems, parking guide systems, anti-lock braking system, Safety and Reliability, Traction Control, skidding& anti-collision | **5 Hours** |
| **Unit- III**<br>**Passenger convenience systems** | Principal Sensor Functions, Distributed Front Air Bag sensing systems, Single-Point Sensing systems, Side-Impact Sensing. Electromechanical Seat, Steering Wheel, and Mirror Adjustments, Central Locking Systems. | **5 Hours** |

**Reference Books:**


1. Automotive Electrics, Automotive Electronics: Systems & Components, 2014,5th Edition, BOSCH.
2. John Turner, Automotive Sensors,2010,1st Edition, Momentum Press, New York.
3. William B. Ribbens, "Understanding Automotive Electronics", Sixth Edition, Newnes, Elsevier Science, ISBN 0-7506-7599-3.
4. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori, "Sensors for Automotive Applications", Volume-4,WILEY-VCHVerlagGmbH&Co.KGaA,Weinheim ISBN:3- 527-29553-4.
5. Vipul Jain, Payam Heydari, "Automotive Radar Sensors in Silicon Technologies", Springer New York Heidelberg Dordrecht London, ISBN 978-1-4419-6774-9

**SEC/P/Elective 2 Practical Based on Automobile Sensors**

Total Credits: 01 Total Contact Hours: 30
Maximum Marks: 50

*The List of Practical's for above course will be provide after commencement of program in consultation with Industry Experts.*