SCHEME & SYLLABI

for

BACHELOR OF VOCATION

In

AUTOMOBILE

with specialisation in

(Electric & Hybrid Vehicle Engineering)

(w.e.f. session 2026-2027)

(As per NEP 2020 & UGC Curriculum and Credit Framework for Undergraduate Programmes – CCFUP)

(Choice Based Credit System with Multiple Entry & Exit and NSQF/NCrF Alignment)

COMMUNITY COLLEGE OF SKILL DEVELOPMENT

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SECTOR-6, FARIDABAD, HARYANA-121006

J. C. Bose University of Science and Technology, YMCA, Faridabad

(formerly YMCA University of Science and Technology)

A State Govt. University established vide State Legislative Act No. 21 of 2009

SECTOR-6, FARIDABAD, HARYANA-121006

VISION

"J.C. Bose University of Science and Technology, YMCA, Faridabad aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building."

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Community College of Skill Development (CCSD)

VISION

"To be a centre of excellence in vocational and skill-based higher education that produces competent, self-reliant and industry-ready professionals with sound technical skills, ethical values and a spirit of innovation and lifelong learning."

MISSION

- To impart quality vocational education integrating theory, hands-on practice and on-the-job training aligned with NSQF/NCrF and industry standards.
- To strengthen employability and entrepreneurship through competency-based, outcome-oriented and skill-intensive curricula.
- To foster multiple entry and exit pathways that empower learners to progress seamlessly across academic and vocational qualifications.

ABOUT THE COMMUNITY COLLEGE OF SKILL DEVELOPMENT (CCSD)

The Community College of Skill Development (CCSD) at J.C. Bose University of Science and Technology, YMCA, Faridabad, was established to advance the national skill-development agenda through industry-aligned, competency-based vocational education under the National Skills Qualifications Framework (NSQF) and the National Credit Framework (NCrF). CCSD offers Bachelor of Vocation (B.Voc.), Diploma and Post-Graduate Diploma programmes that blend academic rigour with extensive practical training, workshops and on-the-job training (OJT) in partnership with industry and Sector Skill Councils.

ABOUT THE PROGRAM

The B.Voc. AUTOMOBILE (with specialisation in Electric & Hybrid Vehicle Engineering) programme is designed in accordance with NEP 2020 and the UGC Curriculum and Credit Framework for Undergraduate Programmes (CCFUP), incorporating a flexible choice-based credit system, multidisciplinary courses and multiple entry and exit options with appropriate NSQF/NCrF-aligned certifications at each year of study. The B.Voc. Degree in Automobile with Specialisation in Electric and Hybrid Vehicle Engineering is designed to impart knowledge, technical skills, and hands-on training in automobiles with a strong focus on four-wheelers and two-wheelers, including petrol, diesel, electric, and hybrid vehicles. The programme is an outcome of emerging industrial demand for skilled manpower in advanced automotive and e-mobility technologies.

TABLE 1 PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To equip students with strong practical and hands-on vocational skills in core and applied areas of Automobile engineering to make them industry-ready and employable.
PEO2	To enable students to service, design, diagnose, and maintain automotive systems, electric mobility solutions, and modern vehicle equipment useful for industries.
PEO3	To improve team building, leadership, ethical values, and social responsibilities among students while working in multidisciplinary automotive and EV environments.
PEO4	To enable students to communicate effectively and efficiently in technical, professional, and entrepreneurial domains.

TABLE 2 PROGRAMME OUTCOMES (POs)

PO1	Vocational & Technical Skills: Apply practical, professional and procedural knowledge to perform skilled automobile technology tasks in routine and non-routine contexts.
PO2	Problem Solving: Identify, analyse and solve well-defined technical problems on the shop floor using appropriate tools, techniques and engineering fundamentals.
PO3	Modern Tool Usage: Select and apply modern equipment, electric and hybrid vehicles, measurement and manufacturing tools and IT resources to accomplish vocational tasks.
PO4	Quality, Safety & Environment: Follow quality standards, occupational health and safety practices and environmentally responsible methods at the workplace.
PO5	Communication & Teamwork: Communicate effectively, document work, and function efficiently as an individual and as a member of multidisciplinary teams.
PO6	Ethics & Professional Conduct: Practise professional ethics, constitutional and human values, and demonstrate accountability and integrity in work and learning.
PO7	Entrepreneurship & Management: Apply basic management, costing and entrepreneurial principles to plan, organise and manage vocational activities and small enterprises.
PO8	Lifelong Learning & Employability: Engage in self-directed and lifelong learning, adapt to emerging technologies, and progress across NSQF/NCrF qualification levels.

TABLE 3 PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1	Apply practical skills, vocational training, and knowledge of automobile servicing fundamentals, including Electric and Hybrid Vehicle technologies, to industrial applications.
PSO2	Develop professional, technical, and entrepreneurial skills to pursue careers, self-employment opportunities, or higher studies in Automobile and Electric Vehicle Engineering with high regard for ethical values and social responsibilities.

TABLE 4 SUSTAINABLE DEVELOPMENT GOALS (SDGs) ADDRESSED

SDG 4	Quality Education — inclusive, equitable quality education and lifelong learning.
SDG 8	Decent Work and Economic Growth — productive employment and decent work for all.
SDG 9	Industry, Innovation and Infrastructure — resilient infrastructure and sustainable industrialization.
SDG 12	Responsible Consumption and Production — sustainable production patterns.
SDG 13	Climate Action — combating climate change through sustainable practices.

TABLE 5 COURSE CODES AND DEFINITIONS (UGC CCFUP CATEGORIES)

L	Lecture
T	Tutorial
P	Practical
DSC	Discipline Specific Course (core vocational/technical)
DSC Lab	Discipline Specific Laboratory / Workshop
MDC	Multidisciplinary Course
AEC	Ability Enhancement Course (language & communication)
VAC	Value Added Course
SEC	Skill Enhancement Course
OJT	On-Job Training / Industrial Training
Project	Project / Field Work
MOOC	Massive Open Online Course (SWAYAM/NPTEL)

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT (CCSD)
SCHEME OF STUDIES & EXAMINATIONS
THREE-YEAR BACHELOR OF VOCATION (B.Voc.) PROGRAMME IN
AUTOMOBILE (WITH SPECIALISATION IN ELECTRIC & HYBRID VEHICLE ENGINEERING)
SEMESTER I – VI (w.e.f. Session 2026-27) (As per NEP 2020 & UGC CCFUP)

TABLE 6

Semester Wise Credit Distribution

Semester	DSC	AEC	MDC	VAC	SEC	Project	Total
I	14		3	3			20
II	13	4	3				20
III	17			3			20
IV	16		2			2	20
V					20		20
VI					20		20
Total Credits	60	4	8	6	40	2	120

Note:

a) A student has to earn at least 3 credits during the duration of the degree by passing at least one MOOC course of a minimum 12-week duration (carrying at least 3 credits) through the SWAYAM / NPTEL platform.

b) A student has to earn 1 credit for the Tree Plantation Activity.

MANDATORY INDUCTION PROGRAMME

When new students enter the institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. A mandatory Induction Programme for the B.Voc. students entering the institution shall be conducted right at the start. Normal classes will begin only after the Induction Programme is over. There is no fixed time limit prescribed for the programme; its duration may be decided by the College/Department as appropriate. Its purpose is to make students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding within the batch as well as between faculty and students, and develop awareness, sensitivity and understanding of the self, the people around them, society at large, and nature.

Tentative activities which may be planned in this Induction Programme are as follows:

- Physical Activity
- Creative Arts

- Universal Human Values
- Literary Activities
- Proficiency Modules
- Lectures by Eminent People
- Visits to Local Area / Industry
- Familiarization to the College / Trade & Innovations

GUIDELINES FOR TREE PLANTATION AND CARE

As approved in the Academic Council, Tree Plantation is a mandatory activity for every student admitted to J. C. Bose University of Science and Technology, YMCA, Faridabad.

Instructions for Students:

1. **Tree Plantation:** Each admitted student is required to plant at least 2-5 tree saplings during his/her first or second semester at any place of their choice at/near their home (e.g., parks, grounds, etc.). The student must capture geo-tagged photographs of the planted saplings (with the student present in the photo) and take proper care of their growth.
2. **Submission of Documents:** The student has to submit geo-tagged photographs of the planted saplings on the University ERP platform in the prescribed format, including the name of the plant, date of plantation and any additional information.
3. **Ongoing Care and Monitoring:** After plantation, every student will take care of these plants and submit updated geo-tagged photos for subsequent years. The plantation document will be submitted once every year for (N-1) times, where N is the total duration of the programme. For example, a student of a 3-year B.Voc. programme has to submit the plantation document for two consecutive years, i.e., up to the pre-final year, indicating the growth and survival of the sapling.
4. **Tree Survival:** The student must ensure the successful survival of at least one tree out of the 2-5 initially planted, to be eligible for the degree.
5. **Verification of Documents:** Verification will be done by the respective teacher-coordinator at each successive year during Practical Examinations towards the end of the semester, as per the notified academic calendar.
6. **Certificate of Achievement:** The certificate for an eligible student will be auto-generated and may be downloaded from the ERP platform after due verification, fulfilling the requirement for degree conferral.

EXIT CRITERIA

For J. C. Bose University of Science and Technology, YMCA, under the NEP 2020 and UGC CCFUP framework, the exit criteria generally require students to secure a minimum of 40% marks in the end-term examinations, in accordance with the University Examination Ordinance. In addition, students must fulfil the prescribed overall credit requirements to be eligible for the different exit options — UG Certificate, UG Diploma or B.Voc. Degree — aligned with the multiple entry and exit provisions of the National Education Policy, the National Skills Qualifications Framework (NSQF) / National Credit Framework (NCrF), and the guidelines of the University Grants Commission. Each year of study is mapped to a corresponding NSQF level: Year 1 → NSQF 4.5, Year 2 → NSQF 5.0, and Year 3 → NSQF 5.5.

TABLE 7 EXIT OPTION DETAILS

S.No.	NSQF Level	Semester	Exit Options	Credits	Additional Credits for Exit	Exit Criteria
1.	4.5	Sem I & II	U.G. Certificate (Automobile with specialisation in Electric & Hybrid Vehicle Engineering)	40	4	Minimum 4–6 weeks of Industrial Internship OR online discipline specific skill courses at the relevant NCRF/NSQF level from NSQF/SSC/SWAYAM/NPTEL/any other recognized certifying agency (comprising either two courses of 2 credits each or one course of 4 credits) OR a Technical Project.
2.	5.0	Sem III & IV	U.G. Diploma (Automobile with specialisation in Electric & Hybrid Vehicle Engineering)	41	4	Minimum 4–6 weeks of Industrial Internship OR online discipline specific skill courses at the relevant NCRF/NSQF level from NSQF/SSC/SWAYAM/NPTEL/any other recognized certifying agency (comprising either two courses of 2 credits each or one course of 4 credits) OR a Technical Project.

Exit Option for U.G. Certificate (Level 4.5): Any student opting for exit after the second semester will get a UG Certificate provided he/she earns 40 credits in the first two semesters and an additional 4 credits based on the exit options as per Table 7. Thus, he/she will be eligible to exit with 44 credits. The Internship Report / Certificate Course / Technical Project would be evaluated by an approved panel of experts.

EMPLOYMENT PATHWAYS AFTER EXIT	
Exit Qualification	U.G. Certificate
NSQF / NCrF Level	4.5
Associated Industry Sectors	Capital Goods, Automotive, Manufacturing, Designing, Maintenance, Servicing, Sales.
Mapped Job Roles	Automobile Workshop Assistant, Service Technician Assistant, Vehicle Maintenance Assistant, Automotive Electrical Assistant, CAD Operator Assistant, Inspection and Quality Assistant, Stores and Inventory Assistant.
Further Progression	Possibility of re-entry into higher semesters through the Academic Bank of Credits (ABC).

Exit Option for U.G. Diploma (Level 5.0): Any student opting for exit after the fourth semester will get a UG Diploma provided he/she earns 40 credits of Semesters I & II, 41 credits of Semesters III & IV, and additional 4 credits based on the exit options as per Table 7. Thus, he/she will be eligible to exit with 85 credits. The Internship Report / Certificate Course / Technical Project would be evaluated by experts from a panel approved by the Principal, CCSD.

EMPLOYMENT PATHWAYS AFTER EXIT	
Exit Qualification	U.G. Diploma
NSQF / NCrF Level	5.0
Associated Industry Sectors	Capital Goods, Automotive, Manufacturing, Designing, Maintenance, Servicing, Sales.
Mapped Job Roles	EV Service Technician, Hybrid Vehicle Technician, Automotive Diagnostic Technician, Battery Maintenance Technician, Mechatronics Technician, EV Charging Station Technician, Quality and Inspection Technician, Production and Assembly Technician.
Further Progression	Possibility of re-entry into higher semesters through the Academic Bank of Credits (ABC).

B.Voc. Degree (Level 5.5): A student completing all six semesters will be awarded the B.Voc. Degree on earning 40 credits of Semesters I & II, 41 credits of Semesters III & IV, and 40 credits of Semesters V & VI (Industrial Training / OJT), subject to the MOOC and Tree-Plantation requirements. The full programme therefore carries 120 + 3* (MOOC) + 1# (Tree Plantation) credits.

NSQF JOB-ROLE & NATIONAL OCCUPATIONAL STANDARDS (NOS) ALIGNMENT

This section maps each year-end NSQF exit point of the B.Voc. AUTOMOBILE (with specialisation in Electric & Hybrid Vehicle Engineering) programme to the appropriate Qualification Pack (QP) / Job Role and aligns the relevant National Occupational Standards (NOS) to specific subjects of the scheme, with brief justifications. Year 1 → NSQF 4.5, Year 2 → NSQF 5.0, Year 3 → NSQF 5.5.

Year-wise NSQF Alignment (Summary)

Exit Year	NSQF Level	Job Role	QP Code / NQR	Sector / Council	NOS Aligned
Year 1 (Sem I & II)	4.5	Automobile Technology	ASC/Q1439	Automotive Skills Development Council (ASDC)	5 Compulsory NOS
Year 2 (Sem III & IV)	5.0	Automotive Assembly Master Technician	ASC/Q3603	Automotive Skills Development Council (ASDC)	5 Core + 12 Employability Modules
Year 3 (Sem V & VI)	5.5	Fundamentals of Electric Vehicle Powertrain Design	ASC/N8119	Automotive Skills Development Council (ASDC)	3 Specialized Core Modules
Year 3 (Sem V & VI)	5.5	Foundation course in Flex Fuel Engine Design	ASC/N8120	Automotive Skills Development Council (ASDC)	3 Specialized Core Modules

YEAR 1 EXIT — NSQF Level 4.5 (Semesters I & II)

Job Role: Automobile Technology
QP Code: ASC/Q1439 Sector: Automotive / Automotive Vehicle Service

NOS - Course Alignment

NOS Code	NOS Title	Aligned Subject(s)	Justification (Brief)
ASC/N9828	Work organization, management and safety (Automobile Technology)	• Fundamentals of Automobile Engineering • Automobile Workshop - 1 & 2 • Environmental Science (VAC-1)	Covers workshop health & safety protocols, 5S standards, hazard identification, personal protective equipment (PPE), and emergency exit drills during lab hours.
ASC/N9829	Communication skills (Automobile Technology)	• Professional Communication Skills (AEC-1) • Computer applications and data visualisation (MDC-1)	Focuses on professional verbal/non-verbal communication, interpretation of technical manuals/schematics, and data documentation.
ASC/N1476	Routine servicing of the vehicle	• Fundamentals of Automobile Engineering • Automobile Workshop - 1 & 2	Directly maps to standard schedules, checklists, replacement of fluids/filters, minor aggregates tuning, and vehicle test drives.
ASC/N1477	Electrical and mechanical systems inspection and diagnosis	• Automotive Electrical and Electronic Systems • Internal Combustion Engine • Automobile Workshop - 2	Maps to mechanical and electrical diagnostics, handling of multimeters, pressure gauges, scanners, and isolating basic faults in engine and body modules.

ASC/N1478	Repair and overhaul	• Internal Combustion Engine • Automobile Workshop - 2 • Manufacturing and Materials Lab	Addresses structural dismantling, component conditioning, component replacement, and performance verification post-repair.

YEAR 2 EXIT — NSQF Level 5.0 (Semesters III & IV) — Job Role A

Job Role: Automotive Assembly Master Technician
QP Code: ASC/Q3603 Sector: Automotive / Automotive Vehicle Service

NOS - Course Alignment

NOS Code	NOS Title	Aligned Subject(s)	Justification (Brief)
ASC/N9810	Manage work and resources (Manufacturing)	Measurement & Instrumentation Lab, Project (Sem IV)	Builds resource planning capabilities, waste reduction, material/energy optimization, and workflow management within a manufacturing environment.
ASC/N9805	Interpret engineering drawing	Computer Aided Design Lab - 1 & 2, Measurement & Instrumentation	Essential for reading 2D orthographic, 3D isometric projections, machine symbols, limit-fits-tolerances, and GD&T symbols.
ASC/N3620	Manage shop floor assembly operations and team	Business management and entrepreneurship essentials, Workshop Calculations and Analytical Techniques	Prepares students for manufacturing management frameworks like TQM, Kaizen, Poka-Yoke, shift roster planning, and ERP data logs.
ASC/N3616	Plan and perform assembly of critical auto parts and aggregates	Motor Vehicle Technology, Electric Motors and Drives Lab, EV Charging and Troubleshooting Lab	Focuses on standard assembly tools (pneumatic, hydraulic, electrical), tightening parameters, torque sequencing, and post-assembly quality auditing.
DGT/VSQ/ N0103	Employability Skills (90 Hours Compulsory Module)	Business management and entrepreneurship essentials, Project (Sem IV)	Fulfills the updated NCVET mandatory modules including Digital Skills, Financial Literacy, Legal Literacy, Diversity & Inclusion, and Interview Preparation.

YEAR 3 EXIT — NSQF Level 5.5 (Semesters V & VI)

Year 3 structural distribution completely transforms into an exhaustive Industrial Training / On-the-Job Training (OJT) matrix, demanding a total workload allocation of 40 Credits (20 Credits per semester). Due to this field immersion, advanced technology tracks have been established to align with engineering R&D paradigms.

Track A: Fundamentals of Electric Vehicle Powertrain Design

• Qualification Pack Alignment: ASC/N8119 (Version 1.0) | SQF Level: 5.5

• Academic Prerequisites Met: Electric and Hybrid Vehicles, Energy Storage Systems for EV, Electric Motors and Drives Lab (Semesters III & IV).

NOS Module Reference	Performance Outcomes & Core Scope	Practical Delivery Mapping via Industrial OJT (Sem V & VI)

Module 1: Prepare on power distribution modes in EV & AEM	Understanding power flow characteristics from energy source to wheels; structural mechanical-electronic interfaces.	OJT Implementation: Evaluating drive configurations (3-wheeler/4-wheeler architectures), modeling energy transfer efficiency, and monitoring inverter-to-traction-motor current characteristics.
Module 2: Designing of Electric Drive Unit (EDU) for optimal balance	Mass optimization, Regenerative braking calibration, power density module layouts (SiC electronics).	OJT Implementation: Running simulation files (Matlab/Python environments), configuring single vs. multi-speed transmissions, and structural sizing of transmission/differential sub-units.
Module 3: EDU design validation at system & vehicle level	eAxle testing, high-voltage test-benches (400V/800V), HiL/SiL testing methods, validation under WLTC/NEDC duty cycles.	OJT Implementation: Executing dynamometer test setups, preparing standard prototype product validation plans for vibration, fatigue, water-ingress IP ratings, and thermal endurance.

Track B: Foundation Course in Flex Fuel Engine Design

- **Qualification Pack Alignment: ASC/N8120, NSQF Level: 5.5**
- *Academic Prerequisites Met: Internal Combustion Engine, Flex Fuel Engines (Semesters II & IV).*

NOS Module Reference	Performance Outcomes & Core Scope	Practical Delivery Mapping via Industrial OJT (Sem V & VI)
Module 1: Prepare on Flex Fuel Vehicle (FFV) systems	Structural modifications for gasoline vs. high-ethanol blends, chemical material compatibility, environmental protection regulations.	OJT Implementation: CAD-assisted layouts tracking material degradation/ corrosion vulnerabilities in fuel pumps, lines, and tank sensors relative to high ethanol (E85/E100) settings.
Module 2: Designing of FFV systems & Engine Management	Design factors of safety (FoS) for lightweight parts, ECU fuel mapping alterations, exhaust sensor positions.	OJT Implementation: Building model-based code parameters for multi-fuel air-injection systems, 3D CAD modeling of updated FFE intake manifolds, and production-ready drawings.
Module 3: Analysis of the effects of Ethanol blend ratios	Thermal and durability simulation of exhaust parts, air-fuel ratio adjustments, spark/injection timing calibration loops.	OJT Implementation: Processing structural and thermal Finite Element Analysis (FEA via ANSYS/ Hypermesh tools) on exhaust systems to counteract unique combustion heat characteristics from ethanol-blended fuels.

Rationale for the NSQF 5.5 Exit: The strategic integration of 40 full credits of Industrial Training in the third year perfectly justifies the award of NSQF Level 5.5. The student effectively transitions from standard operational servicing competencies (Level 4.5) and shop-floor assembly supervisory skills (Level 5.0) into the sophisticated high-demand engineering domain of Independent Process Evaluation, Computer-Aided Simulation, and advanced Systems Validation (Level 5.5). Synthesizing their theoretical foundation in electric motors, battery management systems, and multi-fuel engine layouts, graduates exit the program uniquely competitive for industry designations like Senior Design Technicians, Powertrain Test Engineers, or Quality Validation Specialists.

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
Community College of Skill Development (CCSD)
B.Voc. AUTOMOBILE (with specialisation in Electric & Hybrid Vehicle Engineering)
[NSQF Level 4.5, UG Regular]

TABLE 08

SCHEME FOR SEMESTER – I

Course Code	Course Title	Teaching Schedule				Teaching Hours			Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total	L	P	O/A		Theory	Practical			
AMV-101-V1	Fundamentals of Automobile Engineering	4	0	0	4	60		60	40	60	-	100	4	DSC
AMV-103-V1	Engineering Materials and Manufacturing Processes	4	0	0	4	60		60	40	60	-	100	4	DSC
AMV-109-V1	Computer Aided Design Lab–I	-	-	4	4		30	30	25	-	25	50	2	DSC Lab
AMV-107-V1	Automobile Workshop - 1	-	-	6	6		45	45	25	-	25	50	3	DSC Lab
AMV-111-V1	Manufacturing and Materials Lab	-	-	2	2		15	15	25	-	25	50	1	DSC Lab
ESU-205-V1	Environmental Science	3	-	-	3	45		45	40	60	-	100	3	VAC
AMV-105-V1	Computer applications and data visualisation	3	-	-	3	45		45	40	60	-	100	3	MDC
Total		**14**	**0**	**12**	**26**	**210**	**90**	**300**	**235**	**240**	**75**	**550**	**20**	

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Community College of Skill Development (CCSD)
B.Voc. AUTOMOBILE (with specialisation in Electric & Hybrid Vehicle Engineering)
[NSQF Level 4.5, UG Regular]

TABLE 09

SCHEME FOR SEMESTER – II

Course Code	Course Title	Teaching Schedule				Teaching Hours			Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total	L	P	O/A		Theory	Practical			
AMV-104-V1	Internal Combustion Engine	4	0	0	4	60		60	40	60	-	100	4	DSC
AMV-102-V1	Automotive Electrical and Electronic Systems	4	0	0	4	60		60	40	60	-	100	4	DSC
AMV-108-V1	Computer Aided Design Lab–II	-	-	4	4		30	30	25	-	25	50	2	DSC Lab
AMV-106-V1	Automobile Workshop - 2	-	-	6	6		45	45	25	-	25	50	3	DSC Lab
MRV-101-V1	Workshop Calculations and Analytical Techniques	3		-	3	45		45	40	60		100	3	VAC
AEC-201-V1	Professional Communication Skills	4	-	-	4	60		60	40	60	-	100	4	AEC
Total		**15**	**0**	**10**	**25**	**225**	**75**	**300**	**210**	**240**	**50**	**500**	**20**	

Exit Option for U.G. Certificate (Level 4.5): Any student opting for exit after the second semester will get a UG Certificate on earning 40 credits of the first two semesters plus additional 4 credits as per Table 7 (total 44 credits).

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
Community College of Skill Development (CCSD)
B.Voc. AUTOMOBILE (with specialisation in Electric & Hybrid Vehicle Engineering)
[NSQF Level 5.0, UG Regular]

TABLE 10

SCHEME FOR SEMESTER – III

Course Code	Course Title	Teaching Schedule				Teaching Hours			Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total	L	P	O/A		Theory	Practical			
	Electric and Hybrid Vehicles	4	0	0	4	60		60	40	60	-	100	4	DSC
	Motor Vehicle Technology	4	0	0	4	60		60	40	60	-	100	4	DSC
	Measurement & Instrumentation	3	-	-	3		45	45	40	60	-	100	3	DSC
	Electric and Hybrid Vehicles Lab	-	-	8	8		60	60	25	-	25	50	4	DSC Lab
	Measurement & Instrumentation Lab	-	-	4	4		45	45	25	-	25	50	2	DSC Lab
	Indian Knowledge System	3	-	-	3	30		30	40	60	-	100	2	MDC
Total		**13**	**0**	**14**	**27**	**150**	**150**	**300**	**210**	**240**	**50**	**500**	**20**	

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
Community College of Skill Development (CCSD)
B.Voc. AUTOMOBILE (with specialisation in Electric & Hybrid Vehicle Engineering)
[NSQF Level 5.0, UG Regular]

TABLE 11

SCHEME FOR SEMESTER – IV

Course Code	Course Title	Teaching Schedule				Teaching Hours			Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total	L	P	O/A		Theory	Practical			
	Energy Storage Systems for EV	4	0	0	4	60		60	40	60	-	100	4	DSC
	Mechatronics	4	0	0	4	60		60	40	60	-	100	4	DSC
	Flex Fuel Engines	3	-	-	3	45		45	40	60	-	100	3	MDC
	Electric Motors and Drives Lab	-	-	4	4		30	30	25	-	25	50	2	DSC Lab
	EV Charging and Troubleshooting Lab	-	-	6	6		30	30	25	-	25	50	3	DSC Lab
	Business management and entrepreneurship essentials	2	-	-	2	45		45	40	60	-	100	2	DSC
	Project	-	-	4	4		30	30	30	-	70	100	2	Project
Total		**14**	**0**	**12**	**26**	**210**	**90**	**300**	**240**	**240**	**120**	**600**	**20**	

Exit Option for U.G. Diploma (Level 5.0): Any student opting for exit after the fourth semester will get a UG Diploma on earning 40 + 40 credits of the first four semesters plus additional 4 credits as per Table 7 (total 84 credits).

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
Community College of Skill Development (CCSD)
B.Voc. Automobile with specialisation of Electric and Hybrid Vehicle Engg.
[NSQF Level 5.5, UG Regular]

TABLE 12

SCHEME FOR SEMESTER – V

Course Code	Course Title	Schedule	Credits	Marks for Sessional	Marks for End Term Examination	Total Marks
	Industrial Training / On-Job Training (OJT)	600	17	150	350	500
	Program Elective - I	0	03	40	60	100
Total		**600**	**20**	**190**	**410**	**600**

List of Program Elective - I Courses

Course Code	Course Title
	Introduction to Electric and Hybrid Electric Vehicle
	Autotronics
	Industry 4.0
	Sensors and Actuators
	Fundamentals of Electric Drives

Note: During Semester V, the student undergoes full-time Industrial Training / OJT in industry, supplemented by a Training Report and a Seminar/Presentation.

Procedure for Evaluation of Industrial Training:
(A) End-Term (350 Marks): Training Report 100; Training Seminar 100; Training Viva 150.
(B) Continuous Assessment (150 Marks): Assessment by Internal Faculty 50; Assessment by Industrial Guide 100.

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
Community College of Skill Development (CCSD)
B.Voc. Automobile with specialisation of Electric and Hybrid Vehicle Engg.
[NSQF Level 5.5, UG Regular]

TABLE 12

SCHEME FOR SEMESTER – VI

Course Code	Course Title	Schedule	Credits	Marks for Sessional	Marks for End Term Examination	Total Marks
	Industrial Training / On-Job Training (OJT)	600	17	150	350	500
	Program Elective - II	0	03	40	60	100
Total		600	20	190	410	600

List of Program Elective - II Courses

Course Code	Course Title
	Battery Management Systems (BMS)
	Introduction to Internet of Things (IoT)
	Quality Engineering
	Introduction to Data Analytics
	Automotive Emissions and Control

Note: During Semester VI, the student undergoes full-time Industrial Training / OJT in industry, supplemented by a Training Report and a Seminar/Presentation.

Procedure for Evaluation of Industrial Training:
(A) End-Term (350 Marks): Training Report 100; Training Seminar 100; Training Viva 150.
(B) Continuous Assessment (150 Marks): Assessment by Internal Faculty 50; Assessment by Industrial Guide 100.

DETAILED SYLLABUS

FUNDAMENTALS OF AUTOMOBILE ENGINEERING

Course Code - AMV-101-V1

No of Credits: 4
L T P Total
4 0 0 4

Sessional: 40 Marks
Theory: 60 Marks
Total: 100 Marks

Course Objective:
The course should enable the students to know the basics of automobiles, to understand about the suspension and steering system and wheels and tires.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1: To understand the basics of automobiles, their classification, parts, and performance metrics.
CO2: To able to analyse the functions, requirements, and components of chassis and suspension systems.
CO3: To able to evaluate the necessity, functions, and effectiveness of transmission and braking systems in automobiles. Demonstrate the knowledge of different types of braking systems.
CO4: To synthesize knowledge of steering systems and front axles to understand their purpose, construction, and types.

CO–PO Mapping:

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	1	–	–	–	2
CO2	3	3	2	2	1	–	–	2
CO3	3	3	2	3	1	1	–	2
CO4	3	3	2	2	1	–	–	2

Correlation: 1 = Low, 2 = Medium, 3 = High; "–" = No correlation.

Course Outcomes (COs)	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

Course Contents:

Unit – I: INTRODUCTION
Introduction to an Automobile, Brief history of an Automobile, Classification of Automobiles, Parts of an Automobile, Performance of an Automobile.

Unit – II: CHASSIS AND SUSPENSION
Introduction to Chassis, Classification of Chassis, Frame, Vehicle Dimensions, Introduction to Suspension System Functions/Objects of a Suspension System, Requirements of a Suspension System, Elements of a Suspension System, Springs, Dampers (or Shock Absorbers), Suspension Systems, Wheels and Tires.

Unit – III: TRANSMISSION AND BRAKING SYSTEM
Introduction to Transmission System, Clutch Gearbox (Transmission), Propeller Shaft Universal Joints, Final Drive and Differential, Rear Axles. Introduction to Braking System, Necessity of a Braking System, Functions of Brakes, Requirements of a Good Braking System, Classification of Brakes, Mechanical Brakes, Hydraulic Brakes, Power Brakes, Brake Effectiveness, Anti-locking Braking System.

Unit – IV: STEERING AND FRONT AXLE

Purpose of a Steering System, Functions of a Steering System, Requirements of a Good Steering System, General arrangement of a Steering System, Steering Gears, Steering Ratio, Reversibility, Steering Geometry, Wheel Alignment, Steering Mechanism, Understeering and Oversteering, Steering Linkages, Steering Wheel and Column, Steering Arm, Drag link, Steering Stops, Adjustment of Steering Geometry, Introduction to Front Axle, Construction of Front Axle, Types of Front Axles.

Textbooks & Reference:

1. R.K. Rajput, Automobile Engineering, Laxmi Publications, New Delhi.
2. Dr. Kripal Singh, Automobile Engineering, Standard Publishers Distributors, Delhi.
3. K. Newton, W. Steeds and T.K. Garrett, The Motor Vehicle, Butterworth-Heinemann.
4. V.A.W. Hillier and Peter Coombes, Fundamentals of Motor Vehicle Technology, Nelson Thornes Ltd.
5. Kirpal Singh, Automobile Engineering Vol. I and II, Standard Publishers.
6. William H. Crouse and Donald L. Anglin, Automotive Mechanics, McGraw-Hill Education.
7. Heinz Heisler, Advanced Vehicle Technology, Butterworth-Heinemann.
8. NPTEL/SWAYAM Web Courses on Automobile Engineering and Vehicle Dynamics.

Suggested Tutorial / Sessional Assignments

1. Draw the block diagram of an automobile and identify the major systems and components.
2. Prepare a chart showing the classification of automobiles based on fuel, load, drive, and application.
3. Calculate basic vehicle performance parameters such as power-to-weight ratio and gradeability for a given vehicle.
4. Sketch different chassis frames and compare their applications and advantages.
5. Identify and explain the functions of major elements of suspension systems with suitable diagrams.
6. Prepare a comparative study of leaf springs, coil springs, and shock absorbers used in automobiles.
7. Study different types of wheels and tyres and prepare a report on tyre specifications and markings.
8. Draw the layout of a transmission system and explain the function of clutch, gearbox, propeller shaft, differential and rear axle.
9. Compare mechanical, hydraulic, power-assisted and anti-lock braking systems (ABS) with respect to construction and operation.
10. Calculate brake efficiency and stopping distance for a given set of vehicle parameters.
11. Draw Ackermann steering geometry and explain understeering and oversteering conditions.

ENGINEERING MATERIALS AND MANUFACTURING PROCESSES
Course Code - AMV-103-V1

No of Credits: 4 **Sessional: 40 Marks**

L	T	P	Total	Theory: 60 Marks
4	0	0	4	Total: 100 Marks

Course Objective:
To help vocational students understand the materials used in industry and the common ways parts are made, using simple language and shop-floor examples. The course builds the practical knowledge a robotics/automation technician needs to select materials, recognise manufacturing methods, and appreciate quality and safety, preparing them for CNC, welding, and assembly work in later semesters.

Course Outcomes (COs):
At the end of the course, the student shall be able to:
CO1: Identify common engineering materials, their properties and their suitable applications in manufacturing.
CO2: Explain basic metal-casting and metal-forming processes and where they are used in industry.
CO3: Describe machining, joining (welding) and sheet-metal processes in simple terms.
CO4: Explain basic heat treatment, modern manufacturing (3D printing) and quality/safety practices on the shop floor.

CO–PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	2	1	–	–	2
CO2	3	2	2	2	1	–	–	2
CO3	3	2	3	2	1	–	–	2
CO4	3	2	2	3	1	1	–	3

Correlation: 1 = Low, 2 = Medium, 3 = High; "–" = No correlation.

CO–PSO Mapping:

Course Outcomes	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	3	2
CO4	2	2

Course Contents:

Unit 1: Engineering Materials and Their Properties
Classification of materials — metals, ceramics, polymers and composites; ferrous metals (mild steel, cast iron, alloy steels) and non-ferrous metals (aluminium, copper, brass); mechanical properties (strength, hardness, ductility, toughness, fatigue) explained simply; basic crystal structure idea; selecting the right material for automotive and robotic parts; introduction to smart and lightweight materials.

Unit 2: Casting and Metal Forming
Basics of foundry and sand casting; pattern, mould and core in simple terms; common casting defects; introduction to die casting. Metal forming — forging, rolling, extrusion, drawing and sheet-metal bending; hot working vs cold working; typical industrial products made by each process.

Unit 3: Machining and Joining Processes
Cutting tools and basics of metal removal; working of lathe, drilling, milling and grinding machines; introduction to CNC machining; sheet-metal operations (shearing, punching, bending). Joining processes — arc welding, gas welding, spot welding, soldering and brazing, riveting and adhesive bonding; safety in welding and machining.

Unit 4: Heat Treatment, Modern Manufacturing and Quality
Purpose of heat treatment — annealing, normalising, hardening and tempering in simple language; surface treatments and coatings for wear/corrosion protection. Introduction to additive manufacturing (3D printing) and its

use in robotics; basics of inspection, tolerance and quality control; measuring instruments (vernier, micrometre); shop-floor safety and waste reduction.

Textbooks & References (Indian Authors / AICTE Prescribed):

1. Dheerendra Kumar Dwivedi, “Materials Engineering”, AICTE Prescribed Textbook (NEP 2020), ISBN 978-93-5538-9886 — available in Hindi (हिंदी) and other regional languages.
2. Dheerendra Kumar Dwivedi, “Manufacturing Processes”, AICTE Prescribed Textbook (NEP 2020), ISBN 978-93-5538-7233 — available in Hindi (हिंदी) and other regional languages.
3. Veeranna D. K., “Workshop / Manufacturing Practices (with Lab Manual)”, AICTE Prescribed Textbook (NEP 2020), ISBN 978-93-9150-5332 — available in Hindi (हिंदी).
4. P. N. Rao, “Manufacturing Technology, Vol. 1 & 2”, McGraw-Hill Education.

Suggested Tutorial / Sessional Assignments:

1. Collect five small metal samples and identify each as ferrous or non-ferrous with reasons.
2. Prepare a chart comparing casting, forging and machining for one common product.
3. Watch a welding demonstration and write the safety steps you observed.
4. Measure a given job using a vernier calliper and record the reading.
5. List three products around you made by sheet-metal work.
6. Draw a simple labelled sketch of a lathe and name its main parts.
7. Explain in your own words why hardening and tempering are done together.
8. Find one real example of a 3D-printed part used in robotics and describe it.
9. Prepare a defect list for a casting and suggest one remedy for each.
10. Make a material-selection table for three robot parts (gripper, base, cover).

COMPUTER AIDED DESIGN LAB-I
Course Code - AMV-109-V1

No of Credits: 2 **Sessional: 25 Marks**

L	T	P	Total	Practical: 25 Marks
0	0	4	4	Total: 50 Marks

Course Objective:
To train vocational students in basic engineering drawing and 2D computer-aided design (CAD) using easy, step-by-step practice. Drawing is the language of industry; this lab builds the ability to read and make simple part drawings on AutoCAD-type software, which is essential before CNC, robotics and assembly work.

Course Outcomes (COs):
At the end of the course, the student shall be able to:
CO1: Use basic drawing instruments and CAD software interface to create simple 2D drawings.
CO2: Construct geometric shapes, dimensioning and orthographic (front/top/side) views of simple objects.
CO3: Read and interpret engineering drawings with scales, symbols and tolerances.
CO4: Prepare neat, dimensioned 2D part drawings useful for the manufacturing shop floor.

CO–PO Mapping:

Course Outcomes	PO1 (Voc/Tech)	PO2 (Prob. Solving)	PO3 (Tool Usage)	PO4 (Quality/Safety)	PO5 (Comm/Team)	PO6 (Ethics)	PO7 (Entre/Mgmt)	PO8 (Lifelong)
CO1	3	2	3	1	1	–	–	2
CO2	3	3	3	1	1	–	–	2
CO3	3	2	3	2	2	–	–	2
CO4	3	2	3	2	1	–	–	3

Correlation: 1 = Low, 2 = Medium, 3 = High; "–" = No correlation.

CO–PSO Mapping:

Course Outcomes	PSO1 (Manufacturing & Machining Skills)	PSO2 (Process Planning, Quality & Supervision)
CO1	3	1
CO2	3	1
CO3	2	2
CO4	3	2

Course Contents:

Unit 1: Drawing Basics and CAD Environment
Importance of engineering drawing in industry; drawing sheet, lines, lettering and dimensioning; introduction to CAD software (AutoCAD/equivalent), screen layout, coordinate system, units and basic commands (line, circle, arc, trim, offset).

Unit 2: Geometric Construction and Editing
Drawing polygons, tangents and simple curves; editing commands (copy, mirror, array, fillet, chamfer); layers, hatching and text; applying scale and dimensions correctly.

Unit 3: Orthographic and Sectional Views
Concept of first-angle projection; drawing front, top and side views of simple blocks and machine parts; sectional views and conventions; reading a given engineering drawing.

Unit 4: Component Drawings for the Shop Floor
Dimensioned 2D drawings of common parts (bracket, flange, plate, key, simple gripper part); title block and bill of materials; printing/plotting and saving in standard file formats.

Textbooks & References (Indian Authors / AICTE Prescribed):

1. Pradeep Jain, “Engineering Graphics & Design”, AICTE Prescribed Textbook (NEP 2020), ISBN 978-93-9150-5066 — available in Hindi (हिंदी) and other regional languages.
2. Sharad K. Pradhan & K. K. Jain, “Engineering Graphics”, AICTE Prescribed Textbook (NEP 2020), ISBN 978-93-9150-5509 — available in Hindi (हिंदी).
3. N. D. Bhatt, “Engineering Drawing”, Charotar Publishing House.
4. Sham Tickoo, “AutoCAD: A Problem-Solving Approach”, CADCIM/Dreamtech.

List of Experiments:

1. Set up a drawing sheet with a border and title block in CAD.
2. Draw different types of lines and practise lettering and dimensioning.
3. Construct a regular hexagon and pentagon using CAD commands.
4. Draw the front, top and side views of a simple block.
5. Draw orthographic views of a stepped bracket with dimensions.
6. Create a sectional view of a hollow cylinder.
7. Draw a flange with a bolt-hole circle using the array command.
8. Prepare a dimensioned drawing of a simple robot base plate.
9. Read a given part drawing and prepare a bill of materials.
10. Plot/print a finished drawing to a PDF with the correct scale.
11. Preparation of a dimensioned drawing of a piston and connecting rod assembly.
12. Preparation of 2D drawing of a single-cylinder engine crankshaft.
13. Preparation of isometric drawings of machine blocks and simple automobile components.
14. Preparation of assembly drawing of a knuckle joint or cotter joint.

AUTOMOBILE WORKSHOP - 1

Course Code - AMV-107-V1

No of Credits: 3
L T P Total
0 0 6 6

Sessional: 25 Marks
Theory: 25 Marks
Total: 50 Marks

Course Objectives

To introduce automobile basics, to understand repairing of suspension and steering systems, to study the repairing of automobile wheels and tyres and to perform vehicle overhauling.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1: To comprehend the specifications provided by auto component manufacturers related to various mechanical aggregates of vehicles. Evaluate the main causes of engine part malfunctioning.

CO2: Students will able to apply their understanding to repair and overhaul electrical wire harnesses, lighting, ignition, and electronic systems in vehicles.

Practicals:

1. To understand the various precautions to be taken to avoid damage to the vehicle and its components while working on diagnosis or troubleshooting the vehicle for any faults.
2. To Understand the auto component manufacturer specifications related to the diesel engines, petrol engines, electrical vehicles, gear box, transmission systems, propeller shaft etc.
3. To Service, repair and overhaul of the steering system.
4. To Service, repair and overhaul of suspension system.
5. To Service, repair and overhaul of wheels.
6. To Service, repair and overhaul of cooling system and radiator
7. To Service, repair and overhaul of emission and exhaust system.
8. To Service, repair and overhaul of gearbox, drive-train assembly and transmission systems (manual, automatic etc.)
9. To Service, repair and overhaul of brake system, pneumatic brakes, hydraulic brakes.
10. To Service, repair and overhaul of clutch assembly.
11. To Service, repair and overhaul of single plate and multi plate clutches.
12. To Service, repair and overhaul of hydraulic and pneumatic systems and various lubrication systems.
13. To Service, repair and overhaul of emission and exhaust system.

Textbooks & Reference:

1. Automobile Engineering, Vol. I by Kripal Singh
2. A Textbook of Workshop Technology by R. S. Khurmi and J. K. Gupta

MANUFACTURING AND MATERIALS LAB

Course Code - AMV-111-V1

No of Credits: 1
L T P Total
0 0 2 2

Sessional: 25 Marks
Theory: 25 Marks
Total: 50 Marks

Course Objective:
To introduce engineering materials and their properties, to develop practical skills related to manufacturing processes, machining operations, welding, casting, and measurement techniques used in manufacturing industries.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1: Identify engineering materials and practice safe workshop operations.
CO2: Perform basic manufacturing and machining processes using conventional tools and machines.
CO3: Understand machining parameters and CNC manufacturing systems.

Practicals:

1. To understand workshop safety practices, personal protective equipment (PPE), and safe handling of tools and machines.
2. To identify ferrous and non-ferrous materials and study their properties and industrial applications.
3. To identify polymers, ceramics, composites, and smart materials used in manufacturing industries.
4. To study and perform basic measurements using steel rule, Vernier caliper, micrometer, and dial indicator.
5. To prepare moulds and understand sand casting operations.
6. To perform basic arc welding and gas welding operations.
7. To study and perform sheet metal operations such as cutting, bending, punching, and riveting.
8. To study and perform forging operations and understand metal forming techniques.
9. To identify and study cutting tools used in machining operations.
10. To perform facing, turning, and drilling operations using a lathe machine.
11. To study and perform operations on drilling, milling, and grinding machines.
12. To understand cutting speed, feed, and depth of cut during machining operations.
13. To prepare simple components using conventional machine tools.
14. To study CNC machine components, controls.
15. To observe and understand CNC machining operations.

Textbooks & Reference:

1. Workshop Technology (Vol. I & II) by B. S. Raghuwanshi.
2. Manufacturing Technology by P. N. Rao.

ENVIRONMENTAL SCIENCE

Course Code - ESU-205-V1

No of Credits: 3
L T P Total
3 0 0 3

Sessional: 40 Marks
Theory: 60 Marks
Total: 100 Marks

Course Objective:

The course aims to provide students with an understanding of the interactions between humans and the environment, natural resources, biodiversity, environmental pollution, climate change, and environmental management. It also seeks to develop awareness of sustainable development practices and familiarize students with national and international environmental laws and treaties for promoting responsible environmental stewardship.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1: Explain the historical evolution of human-environment interactions and the emergence of environmental thought and global environmentalism.
CO2: Analyze the classification, utilization, and sustainable management of natural resources, and relate them to the principles of sustainable development.
CO3: Evaluate the concepts of biodiversity and ecosystem services, conservation approaches.
CO4: Identify major types of environmental pollution and assess their sources, impacts on human health and ecosystems; assess the significance of climate change impacts, adaptation, and mitigation.
CO5: Interpret key national and international environmental laws, treaties, and institutional mechanisms aimed at environmental protection and sustainable governance.

CO–PO Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	1	2	1	2	–	3
CO2	2	3	2	3	1	2	1	3
CO3	2	3	2	3	1	2	–	3
CO4	2	3	2	3	1	3	1	3
CO5	1	2	2	3	2	3	1	3

CO–PSO Mapping

Course Outcomes (COs)	PSO1	PSO2
CO1	1	2
CO2	2	3
CO3	2	3
CO4	2	3
CO5	1	3

Course Contents:

Unit – I: Humans and the Environment

The man-environment interaction: Humans as hunter-gatherers, Mastery of fire, Origin of agriculture, Great ancient civilizations and the environment, Industrial revolution and its impact on the environment, Population growth and natural resource exploitation. The emergence of environmentalism: Anthropocentric and eco-centric perspectives, The Club of Rome- Limits to Growth, UN Conference on Human Environment 1972, World Commission on Environment and Development, Rio Summit.

Unit – II: Natural Resources and Sustainable Development
Definition of resource; Classification of natural resources- biotic and abiotic, renewable and nonrenewable. Biotic resources: Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine), Microbes as a resource. Water resources: Types of water resources- fresh water and marine resources, Availability and use, Environmental impact of over-exploitation, issues and challenges, Water scarcity and stress, Conflicts over water. Soil and mineral resources: Important minerals, Mineral exploitation, Environmental problems due to extraction of minerals and use, Soil as a resource and its degradation. Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy, Conventional energy sources- coal, oil, natural gas, nuclear energy, non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells, Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)

Unit – III: Environmental Issues: Local, Regional and Global
Temporal and spatial extents of local, regional, and global phenomena. Pollution: Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste, Transboundary air pollution, Acid rain, Smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Global issues: Ozone layer depletion, Green-house effect, Global Warming, Climate change.

Unit – IV: Conservation of Biodiversity and Ecosystems
Ecosystems and ecosystem services: Concept; Structure and Functions of Ecosystem, Ecosystem types forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services. Biodiversity and its distribution: Biodiversity as a natural resource, Levels and types of biodiversity, Biodiversity in India and the world, Biodiversity hotspots. Threats to biodiversity, in-situ and ex-situ conservation approach, role of traditional knowledge, community-based conservation.

Unit – V: Environmental Pollution and Health
Definition of pollution; Point sources and non-point sources of pollution. (5 hrs) Air pollution: Sources of air pollution, Primary and secondary pollutants, Criteria pollutants, Other important air pollutants- Volatile Organic compounds, Peroxyacetyl Nitrate, Polycyclic aromatic hydrocarbons and Persistent organic pollutants, Indoor air pollution, health impacts of air pollutants, National Ambient Air Quality Standards. Water pollution: Sources of water pollution, River, lake and marine pollution, groundwater pollution, Water quality parameters and standards, health impacts of water pollution on human and aquatic life. Soil pollution and solid waste: Soil pollutants and their sources, Solid and hazardous waste, Impact on human health. Noise pollution: Definition of noise, measurement and sources of noise pollution, Noise standards, impacts of noise on human health. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.

Unit – VI: Climate Change: Impacts, Adaptation and Mitigation
Structure of atmosphere, Importance of 1.5 °C and 2.0 °C limits to global warming, Climate change projections for the Indian sub-continent. Impacts of climate change on ocean, land, forests and natural ecosystems, Impacts on animal species, agriculture, health, urban infrastructure; concept of vulnerability, Adaptation vs. resilience, Indigenous knowledge for adaptation to climate change. Mitigation measures: Green House Gas (GHG) reduction vs. sink enhancement, carbon neutrality, Net zero targets for the future, Energy efficiency measures, National climate action plan.

Unit – VII: Environmental Management
Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g); Introduction to environmental legislations on the forest, wildlife and pollution control. Environmental management system: ISO 14001. Environmental audit and impact assessment, Pollution control and management, Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability, Ecolabeling /Ecomark scheme.

Unit – VIII: Environmental Treaties and Legislation
Vienna Convention; Montreal Protocol and the Kigali Amendment. Basel Convention, Stockholm Convention on Persistent Organic Pollutants, Minamata Convention. United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol, Paris Agreement, India's status as a party to major conventions.
National Green Tribunal, Convention on Biological Diversity (CBD), Cartagena Protocol, Nagoya Protocol, Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), Ramsar Convention on Wetlands of International Importance, Ramsar sites, United Nations Convention to Combat Desertification

(UNCCD).

Textbooks & Reference:

1. Barrow, C. J. (1999). Environmental management: Principles and practice. Routledge.
2. Berrang-Ford, L., J.D. Ford & J. Paterson (2011). Are we adapting to climate change? Global Environmental Change-Human and Policy Dimensions 21: 25-33.
3. Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson.
4. De Anil, K. (2003). Environmental chemistry. New Age International.
5. Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Publisher (Pearson)
6. India Code - Digital repository of all Central and State Acts: https://www.indiacode.nic.in/
7. Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press.
8. Kaushik, A., & Kaushik, C. P. (2006). Perspectives in environmental studies. New Age International.
9. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK
10. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.
11. Ela Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.
12. Simmons, I. G. (2008). Global Environmental History: 10,000 BC to AD 2000. Edinburgh University Press

COMPUTER APPLICATIONS AND DATA VISUALISATION

Course Code - AMV-105-V1

No of Credits: 3
L T P Total
3 0 0 3

Sessional: 40 Marks
Theory: 60 Marks
Total: 100 Marks

Course Objectives:

The objective of this course is to provide fundamental knowledge of computer applications, digital tools, data handling techniques, and data visualization methods required for academic, industrial, and professional applications. The course also aims to develop the ability to organize, analyze, and present data effectively using spreadsheet and visualization tools.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1: Understand the fundamentals of computers and various digital applications.
CO2: Use operating systems, internet services, and office productivity tools effectively.
CO3: Perform data organization, analysis, and computations using spreadsheet software.
CO4: Create charts, dashboards, and visual representations of data for effective decision-making.

CO–PO Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	2	1	1	–	–	2
CO2	2	2	3	1	2	1	–	2
CO3	2	3	3	1	1	–	–	2
CO4	2	3	3	2	2	1	1	3

CO–PSO Mapping

Course Outcomes (COs)	PSO1	PSO2
CO1	1	2
CO2	1	2
CO3	2	3
CO4	2	3

Course Contents:

Unit – I: Fundamentals of Computer Applications

Introduction to Computers, Characteristics and Applications of Computers, Types and Generations of Computers, Basic Components of Computer System, Input and Output Devices, Memory Units and Storage Devices, CPU and its Functions, Computer Hardware and Software, Operating Systems and their Functions, File and Folder Management, Introduction to Cloud Computing and Digital Technologies.

Unit – II: Internet and Digital Tools

Introduction to Internet and Web Browsers, Search Engines, E-mail and Digital Communication, Video Conferencing Tools, Cloud Storage and File Sharing, Social Media Applications, Digital Payment Systems, Basics of Networking and Wi-Fi, Cyber Safety and Security, Computer Viruses and Antivirus Software, Introduction to Artificial Intelligence and Generative AI Tools.

Unit – III: Spreadsheet Applications and Data Analysis

Introduction to Spreadsheet Software (MS Excel/Google Sheets), Worksheets and Workbooks, Data Entry and Formatting, Cell Referencing, Sorting and Filtering, Conditional Formatting, Mathematical and Statistical Functions, Logical Functions, Lookup Functions, Data Validation, Pivot Tables, Data Analysis and Summarization, Import and Export of Data.

Unit – IV: Data Visualization and Presentation Tools

Principles of Data Visualization, Types of Charts and Graphs, Creation of Bar Charts, Line Charts, Pie Charts, Histograms and Scatter Plots, Dashboards and Reports, Data Interpretation and Decision Making, Introduction to Power BI and Google Looker Studio, Presentation Techniques using MS PowerPoint, SmartArt, Animation and Slide Transitions, Introduction to Google Slides.

Textbooks & Reference:

1. V. Rajaraman, Computer Fundamentals, PHI Learning.
2. P. K. Sinha and Priti Sinha, Computer Fundamentals, BPB Publications.
3. Joan Lambert, Microsoft Excel Step by Step, Microsoft Press.
4. Alexis Leon and Mathews Leon, Fundamentals of Information Technology, Vikas Publishing House.
5. Peter Norton, Introduction to Computers, McGraw-Hill Education.
6. Ramesh Bangia, Learning Computer Fundamentals, MS Office and Internet, Khanna Book Publishing.
7. Wayne Winston, Microsoft Excel Data Analysis and Business Modeling, Microsoft Press.
8. Alberto Cairo, The Truthful Art: Data, Charts, and Maps for Communication, New Riders.
9. Cole Nussbaumer Knaflic, Storytelling with Data: A Data Visualization Guide for Business Professionals, Wiley.
10. NPTEL/SWAYAM Web Courses on Computer Fundamentals, Spreadsheet Applications and Data Visualization.

Suggested Tutorial / Sessional Assignments

1. Identify the components of a computer system and prepare a report on different generations and types of computers.
2. Perform file and folder management operations and study the functions of operating systems.
3. Create and manage documents using cloud storage platforms and study the applications of digital technologies.
4. Conduct web searches using search engines and create professional e-mail accounts with attachments and signatures.
5. Study video conferencing platforms and demonstrate file sharing through cloud-based applications.
6. Prepare a report on cyber security threats, computer viruses and the role of antivirus software.
7. Explore digital payment systems and prepare a case study on safe online transactions.
8. Study the applications of Artificial Intelligence and Generative AI tools in education and industry.
9. Create spreadsheets using MS Excel or Google Sheets and perform formatting, sorting and filtering operations.
10. Apply mathematical, statistical and logical functions for solving practical problems using spreadsheets.

INTERNAL COMBUSTION ENGINE

Course Code - AMV-104-V1

No of Credits: 4
L T P Total
4 0 0 4

Sessional: 40 Marks
Theory: 60 Marks
Total: 100 Marks

Course Objectives:

This course is designed to help students to understand the concepts of internal combustion engines, its combustion and various testing & performance parameters.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1: To understand the basic principles, components, classifications, and working cycles of internal combustion engines, along with the differences between 4-stroke and 2-stroke engines and SI and CI engines.
CO2: To evaluate the combustion phenomenon in SI engines, understand the factors affecting ignition timing and performance parameters, and analyze various types of combustion chambers.
CO3: To understand the combustion phenomenon in CI engines, including ignition lag, diesel knock, combustion chamber design, and cold starting procedures.
CO4: To synthesize knowledge to conduct testing and evaluate the performance of IC engines, including measuring performance parameters, analyzing engine performance curves, and comparing petrol and diesel engines.

CO–PO Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	1	–	–	–	2
CO2	3	3	2	2	1	–	–	2
CO3	3	3	2	2	1	–	–	2
CO4	3	3	3	3	1	1	1	3

CO–PSO Mapping

Course Outcomes (COs)	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	3

Course Contents:

Unit – I: FUNDAMENTALS OF IC ENGINE

Basic idea of IC Engines, different parts and terms connected with IC Engines, Classification of IC Engines, applications of IC Engines, engine cycle energy balance, working cycles, indicator diagram, 4 stroke cycle engine, 2 stroke cycle engine, comparison of 4 stroke and 2 stroke engines, comparison of SI and CI engine.
Intake for Two Stroke Cycle Engines, Scavenging Process, Scavenging Parameters, Scavenging Systems, Crankcase Scavenging, Scavenging Pumps and Blowers.

Unit – II: COMBUSTION IN SI ENGINE

Introduction to combustion in SI Engine. Combustion Phenomenon, Effect of Engine Variables on Ignition Lag, Spark Advance and Factors Affecting Ignition Timing, Pre-ignition, Detonation, Performance Number, Highest Useful Compression Ratio (HUCR), Combustion Chamber Design-S.I. Engines, Some Types of Combustion Chambers.

Unit – III: COMBUSTION IN CI ENGINE

Introduction to Combustion in C.I. Engines. Combustion Phenomenon in C.I. Engines Fundamentals of the Combustion Process in Diesel Engines. Delay Period (or Ignition Lag) in C.I. Engines. Diesel Knock. C.I. Engine Combustion Chambers. Cold Starting of C.I. Engines.

Unit – IV: TESTING AND PERFORMANCE OF IC ENGINE

Testing and Performance of I.C. Engines, Introduction to Testing and Performance of I.C. Engines Performance Parameters, Basic Measurements, Engine Performance Curves, Comparison of Petrol and Diesel Engines-Fuel Consumption, Load Outputs and Exhaust Composition, Governing of I.C. Engines, Noise Abatement.

Textbooks & Reference:

1. R. K. Rajput, Automobile Engineering, Laxmi Publications.
2. A. K. Babu, S. C. Sharma and T. R. Banga, Automobile Mechanics, Khanna Publishing House.
3. Kirpal Singh, Automobile Engineering, Standard Publishers Distributors.
4. V. Ganesan, Internal Combustion Engines, McGraw Hill Education.
5. Mathur, M. L. and Sharma, R. P., A Course in Internal Combustion Engines, Dhanpat Rai Publications.
6. Sharma, P. C., A Textbook of Automobile Engineering, S. Chand Publications.
7. NPTEL/SWAYAM Web Courses on Internal Combustion Engines and Automotive Power Plants.

Suggested Tutorial / Sessional Assignments

1. Draw the layout of an internal combustion engine and identify its major components and terminology.
2. Prepare a classification chart of IC engines based on cycle, fuel used, cooling method, ignition method and number of cylinders.
3. Draw and explain the working of four-stroke SI and CI engines using P-V and indicator diagrams.
4. Compare two-stroke and four-stroke engines and prepare a report highlighting their advantages and limitations.
5. Study various scavenging systems used in two-stroke engines and compare their performance characteristics.
6. Draw and explain different combustion chambers used in SI engines and discuss their effects on engine performance.
7. Study the phenomena of pre-ignition and detonation and suggest methods for their prevention.
8. Explain ignition lag and diesel knock in CI engines and compare combustion processes in SI and CI engines.
9. Draw various combustion chambers used in diesel engines and discuss their applications.
10. Study the cold starting methods employed in CI engines and prepare a report on starting aids used in modern diesel engines.

AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS
Course Code - AMV-102-V1

No of Credits: 4
L T P Total
4 0 0 4

Sessional: 40 Marks
Theory: 60 Marks
Total: 100 Marks

Course Objectives:
The course aims to provide students with fundamental knowledge of electrical and electronic engineering principles and their applications in automotive systems. It also introduces batteries, charging systems, ignition systems, automotive wiring, lighting systems, sensors, and instruments used in conventional and modern automobiles.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1: Understand basic electrical principles and analyze DC circuits and electrical quantities used in automobiles.
CO2: Explain the operation and applications of semiconductor devices and basic electronic circuits used in automotive systems.
CO3: Evaluate the construction and operation of batteries, charging systems, starter motors, and ignition systems.
CO4: Examine automotive wiring systems, lighting systems, dashboard instruments, sensors, and auxiliary electrical components.

CO–PO Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	1	–	–	2
CO2	3	3	3	1	1	–	–	2
CO3	3	3	3	2	1	1	–	2
CO4	3	2	3	2	1	1	1	3

CO–PSO Mapping

Course Outcomes (COs)	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	3

Course Contents:

UNIT-I BASIC ELECTRICAL TECHNOLOGY

Concept of Electric Current, Voltage, Resistance, Power and Energy, Ohm's Law, Kirchhoff's Laws, Series and Parallel Circuits, Electromagnetism and Electromagnetic Induction, Capacitors and Inductors, AC and DC Current, Single-phase and Three-phase Supply, Electrical Measuring Instruments (Voltmeter, Ammeter, Ohmmeter and Multimeter), Electrical Safety Practices, Fuses, Relays and Switches, Applications of Electrical Principles in Automobiles.

UNIT-II BASIC ELECTRONICS FOR AUTOMOTIVE APPLICATIONS

Semiconductor Materials, P-N Junction Diode and its Characteristics, Rectifiers, Zener Diode, LED, Transistors and their Working Principles, Basic Amplifier and Switching Circuits, Introduction to Integrated Circuits (ICs), Sensors and Actuators used in Automobiles, Basics of Digital Electronics, Logic Gates, Microcontrollers and their Applications in Automotive Systems, Electronic Control Unit (ECU) – Introduction and Functions.

UNIT-III AUTOMOTIVE ELECTRICAL SYSTEMS

Types of Automotive Batteries, Construction and Characteristics of Lead Acid, Nickel-Metal Hydride and Lithium-Ion Batteries, Battery Capacity and Efficiency, Battery Testing and Maintenance, Battery Charging Techniques, Starter Motors and their Types, Solenoids and Starter Drives, Charging System Components, Generators and Alternators, Voltage and Current Regulation, Charging Circuits, Battery Coil Ignition System, Magneto Ignition System, Spark Plugs and Ignition Timing Mechanisms.

UNIT-IV AUTOMOTIVE ELECTRONIC SYSTEMS, WIRING AND INSTRUMENTATION

Electronically Assisted Ignition System, Capacitive Discharge Ignition (CDI), Distributor-less Ignition System (DIS), Digital Ignition System, Automotive Wiring Systems, Positive and Negative Earth Systems, Headlamps and Signal Lamps, Horns and Wiper Mechanisms, Electric Fuel Pumps, Dashboard Instruments, Speedometer, Odometer, Fuel Level Indicator, Oil Pressure Indicator, Coolant Temperature Indicator, Sensors used in Automotive Systems and Basic Automotive Wiring Circuits.

Textbooks & Reference:

1. Kohli, P. L., **Automotive Electrical Equipment**, Tata McGraw-Hill, New Delhi.
2. Young, A. P. and Griffith, S. L., **Automobile Electrical Equipment**, ELBS and New Press.
3. Rajput, R. K., **Basic Electrical Engineering**, Laxmi Publications.
4. Bhattacharya, S. K., **Basic Electrical and Electronics Engineering**, Pearson Education.
5. Babu, A. K., **Automotive Electricals and Electronics**, Khanna Publishers.
6. NPTEL/SWAYAM Web Courses on Basic Electrical Engineering, Basic Electronics and Automotive Electrical Systems.

Suggested Tutorial / Sessional Assignments

1. Verify Ohm's law and analyze series and parallel circuits used in automotive applications.
2. Measure voltage, current and resistance using voltmeter, ammeter, ohmmeter and multimeter.
3. Prepare a comparative chart showing AC and DC supply systems and their applications in automobiles.
4. Identify and explain the functions of fuses, relays and switches used in automotive electrical circuits.
5. Draw the characteristics of P-N junction diode, Zener diode and LED and explain their applications.
6. Study transistor switching circuits and basic amplifier circuits used in automotive electronic systems.
7. Prepare truth tables and implement basic logic gates used in digital electronics.
8. Prepare a report on sensors, actuators, microcontrollers and Electronic Control Units (ECUs) used in modern automobiles.
9. Compare the construction and characteristics of Lead Acid, Nickel-Metal Hydride and Lithium-Ion batteries.
10. Determine battery capacity and efficiency and study battery testing and maintenance procedures.
11. Draw and explain the construction and working of starter motors, alternators and charging circuits.
12. Compare battery coil ignition, magneto ignition, CDI, distributor-less ignition and digital ignition systems.
13. Study positive-earth and negative-earth wiring systems and prepare basic automotive wiring diagrams.

COMPUTER AIDED DESIGN LAB–II
Course Code - AMV-108-V1

No of Credits: 2 | **Sessional: 25 Marks**

L	T	P	Total
0	0	4	4

Practical: 25 Marks

Total: 50 Marks

Course Objective:
To advance students from 2D drawing to 3D part modelling and simple assembly using parametric CAD software. These skills are directly used in product design, 3D printing and robotics, and prepare students for CNC/CAM work in the second year.

Course Outcomes (COs):
At the end of the course, the student shall be able to:
CO1: Create 3D part models from 2D sketches using a parametric CAD package.
CO2: Apply features such as extrude, revolve, fillet, pattern and shell to build components.
CO3: Assemble parts with mating constraints and check basic fit.
CO4: Generate dimensioned 2D production drawings from 3D models for the shop floor.

CO–PO Mapping:

Course Outcomes	PO1 (Voc/Tech)	PO2 (Prob. Solving)	PO3 (Tool Usage)	PO4 (Quality/Safety)	PO5 (Comm/Team)	PO6 (Ethics)	PO7 (Entre/Mgmt)	PO8 (Lifelong)
CO1	3	3	3	2	1	–	–	2
CO2	3	3	3	2	1	–	–	2
CO3	3	3	3	2	2	–	–	2
CO4	3	2	3	2	1	–	–	3

Correlation: 1 = Low, 2 = Medium, 3 = High; "–" = No correlation.

CO–PSO Mapping:

Course Outcomes	PSO1 (Manufacturing & Machining Skills)	PSO2 (Process Planning, Quality & Supervision)
CO1	3	1
CO2	3	1
CO3	3	2
CO4	3	2

Course Contents:

Unit 1: Sketching and Part Modelling (Module 1)
Introduction to 3D CAD (Fusion/SolidWorks/FreeCAD type); constrained sketching; extrude and revolve to make simple solids; the parametric/feature-tree idea.

Unit 2: Advanced Features (Module 2)
Fillet, chamfer, shell, rib, hole and pattern features; reference planes; editing dimensions to change the model; modelling common machine parts.

Unit 3: Assembly Modelling (Module 3)
Inserting parts, applying mates/constraints; building a small assembly (e.g., simple gripper or bracket-bolt assembly); interference/fit check; exploded view.

Unit 4: Drawing Generation and Output (Module 4)
Creating drawing views from a 3D model; dimensioning, section and detail views; title block and BOM; exporting STL for 3D printing and PDF for the shop floor.

Textbooks & References (Indian Authors / AICTE Prescribed):
1. Pradeep Jain, "Engineering Graphics & Design", AICTE Prescribed Textbook (NEP 2020), ISBN 978-93-9150-5066 — available in Hindi (हिंदी) and other regional languages.

2. Kanak Kalita, “Computer Aided Machine Drawing Practice”, AICTE Prescribed Textbook (NEP 2020), ISBN 978-93-5538-3570 — available in Hindi (हिंदी).
3. N. D. Bhatt & V. M. Panchal, “Machine Drawing”, Charotar Publishing House.
4. Sham Tickoo, “SolidWorks / Fusion 360 for Designers”, CADCIM/Dreamtech.

List of Experiments:

1. Model a simple block with a through hole using extrude.
2. Create a stepped shaft using Revolve.
3. Apply fillet, chamfer and shell to a box model.
4. Use a circular pattern to make a bolt-hole flange.
5. Model a simple bracket from a given 2D drawing.
6. Build a two-part assembly with mates and check the fit.
7. Create an exploded view of the assembly.
8. Generate a dimensioned drawing from a 3D model.
9. Export a part as STL for 3D printing.
10. Model a simple robot gripper finger and prepare its drawing.
11. Preparation of a 3D model of a piston with piston rings and piston pin.
12. Preparation of a 3D model of connecting rod and generation of detailed engineering drawing.
13. Preparation of a 3D model of crankshaft and flywheel.
14. Preparation of a 3D model of spur gear and gear shaft assembly.
15. Preparation of a 3D model of leaf spring and helical compression spring.

AUTOMOBILE WORKSHOP - 2

Course Code - AMV-106-V1

No of Credits: 4
L T P Total
0 0 8 8

Sessional: 25 Marks
Theory: 25 Marks
Total: 50 Marks

Course Objective:
After completing this course, students will be able perform repairing of suspension and steering systems, to understand functioning of automobile's wheels and tyres, to perform vehicle overhauling.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1: Apply knowledge of two-stroke and four-stroke diesel engines to perform overhauling and repair operations, demonstrating understanding and application of engine components and functions.
CO2: Apply knowledge of two-stroke and four-stroke petrol engines to perform overhauling and repair operations, demonstrating understanding and application of engine components and functions.
CO3: Demonstrate proficiency in tuning a multi-cylinder petrol engine, adjusting critical parameters such as dwell, rpm, ignition timing, and component clearances.
CO4: Analyze and calculate the mechanical efficiency of a multi-cylinder engine using Morse Test, demonstrating evaluation and problem-solving skills in engine performance.

Practicals:

1. To understand the working of two stroke and four stroke diesel engines, perform overhauling and repair operations.
2. To understand the working of two stroke and four stroke petrol engines, perform overhauling and repair operations.
3. Find the mechanical efficiency of a multi-cylinder engine by Morse Test.
4. Tune a multi-cylinder petrol engine and set dwell, rpm, ignition timing, CB point gap, spark plug gap, and tappet clearance.
5. Dismantle and assemble the given electrical fuel pump. Check it for proper working.
6. Set the cut-out and regulator of a vehicle.
7. Dismantle, study, and re-assemble multi-cylinder F.I. pump.
8. Test a multi-cylinder F.I. pump on the calibrating machine and check it for proper phasing. Set the injection timing on the engine.
9. Test a diesel fuel injector and set injection pressure. Grind needle and seat.
10. Study and sketch rotary F.I. pump.
11. Study of working of electric vehicles.

Textbooks & Reference:

1. Vehicle Maintenance and Garage Practice by Doshi J.A

PROFESSIONAL COMMUNICATION SKILLS
Course Code - AEC-201-V1

No of Credits: 4
L T P Total
4 0 0 4

Sessional: 40 Marks
Theory: 60 Marks
Total: 100 Marks

Course Objective:

To develop students' foundational proficiency in English language usage by strengthening grammar, vocabulary, sentence construction and basic writing skills. The course aims to improve learners' ability to read, understand and compose clear English for academic, workplace and everyday communication.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1: Identify and correctly use parts of speech, tenses, voice, and narration in written and spoken English.

CO2: Communicate effectively with stakeholders (customers, colleagues, industry partners) using appropriate professional etiquette.

CO3: Draft professional documents including letters, reports, emails, resumes, and essays.

CO4: Demonstrate effective presentation, group discussion, and interview skills with appropriate body language and confidence.

CO5: Apply soft skills such as teamwork, leadership, paraphrasing, and feedback-giving in workplace scenarios.

CO–PO Mapping:

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	1	1	1	2	2
CO2	3	2	3	1	1	1	2	2
CO3	2	2	3	2	1	1	2	2
CO4	2	2	3	2	2	1	3	3

Correlation levels: 1 = Low, 2 = Medium, 3 = High; "–" = No correlation.

CO–PSO Mapping:

Course Outcomes (COs)	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	2	3
CO4	2	3

Course Contents:

Unit 1: GRAMMAR FOUNDATIONS (10 Lectures)

Parts of Speech: Noun, Pronoun, Verb, Adverb, Adjective, Preposition, Conjunction, Interjection, Tenses: Present, Past, Future (identification and sentence construction), Sentence Formation: Simple, Compound, Complex, Compound-Complex, Active-Passive Voice, Direct-Indirect Narration, Word Formation: Prefix, Suffix, Roots, Antonyms, Synonyms, Phrases & Idioms.

Unit 2: WRITING SKILLS (11 Lectures)

Letter Writing: Formal, Application, Covering, Business Letters, Report Writing: Academic, Business, Technical, News Reports, Essay Writing, Articles, Story Narration, E-mail Writing and Resume Writing, Reading Comprehension (skimming, scanning, summarizing).

Unit 3: VERBAL & NON-VERBAL COMMUNICATION (11 Lectures)

Communication: Meaning, Importance, Functions, Types, Barriers & Solutions, Telephonic Communication Skills: Opening/closing calls, dealing with angry customers, Listening & Speaking Skills: Literacy skills integration, Body Language: Gesture, Posture, Facial Expression, Paraphrasing & Basic Translation skills, Reading Skills: Levels of reading, skimming, scanning.

Unit 4: EMPLOYABILITY & PERSONALITY DEVELOPMENT (10 Lectures)

Soft Skills: Definition, Importance, Process, Measurement, Teamwork Skills, Leadership Skills, Interview – Types (Mock interviews), Personality Development: Types, Programs & Techniques, Group Discussion – strategies and practice, Presentation Skills: Types, making effective presentations, Feedback: Giving and receiving constructive feedback, Stakeholder Communication: Customers, industry partners, suppliers, agents.

Textbooks & References:

1. Wren and Martin, *High School English Grammar and Composition*, latest edition, S. Chand.
2. Raymond Murphy, *Essential English Grammar*, latest edition, Cambridge University Press.
3. Prerna Malhotra & Deb Halder, Communication Skills: Theory and Practice.
4. B. Mishra & S. Sharma, Communication Skills for Engineers and Scientists.
5. Selected reading passages, worksheets and teacher-prepared handouts for grammar, vocabulary and writing practice.

Suggested Tutorial / Sessional Assignments:

1. Identify and classify the parts of speech in a short paragraph and explain the function of each highlighted word.
2. Rewrite a set of sentences in present, past and future tense without changing their meaning.
3. Form new words using prefixes and suffixes, and use them correctly in original sentences.
4. Replace underlined words in a passage with suitable synonyms or antonyms based on context.
5. Convert sentences from active to passive voice and from direct to indirect narration.
6. Combine short clauses into simple, compound and complex sentences.
7. Write a short paragraph on a familiar topic using correct tense forms and connectors.
8. Write an essay or article on a given topic with a clear introduction, body and conclusion.
9. Read a comprehension passage and answer factual, vocabulary-based and inferential questions.
10. Develop a short story using suitable conjunctions, interjections and descriptive vocabulary.

Practical Exercises

1. Grammar & Writing – Identify parts of speech in a paragraph; convert sentences across tenses, voice, narration; write a story using prepositions, conjunctions, interjections.
2. Letter & Report Writing – Draft formal letters, resumes, and reports from case studies.
3. Group Discussion & Paraphrasing – Participate in GD; paraphrase given passages.
4. Role-plays – Team projects, leadership situations, telephonic role-plays (customer service scenarios).
5. Presentations – Deliver short presentations focusing on non-verbal cues (gesture, posture).
6. Reading & Summarizing – Practice skimming/scanning; summarize texts.

WORKSHOP CALCULATIONS AND ANALYTICAL TECHNIQUES
Course Code - MRV-101-V1

No of Credits: 3 **Sessional: 40 Marks**

L	T	P	Total	Theory: 60 Marks
0	0	3	3	Total: 100 Marks

Course Objective:
To strengthen the everyday mathematics and measurement skills a shop-floor technician needs, taught in a simple, application-based way. The course covers practical arithmetic, mensuration, basic algebra and simple data handling so that students can read drawings, calculate quantities, estimate cost and make data-based decisions in manufacturing and analytics.

Course Outcomes (COs):
At the end of the course, the student shall be able to:
CO1: Apply basic arithmetic, units, ratios, percentages, and unit conversion to workshop problems.
CO2: Use mensuration and basic trigonometry to calculate length, area, volume and angles of parts.
CO3: Apply simple algebra and graphs to solve practical shopfloor and measurement problems.
CO4: Organise simple data and compute basic statistics (average, range) to support quality decisions.

CO–PO Mapping:

Course Outcomes	PO1 (Voc/Tech)	PO2 (Prob. Solving)	PO3 (Tool Usage)	PO4 (Quality/Safety)	PO5 (Comm/Team)	PO6 (Ethics)	PO7 (Entre/Mgmt)	PO8 (Lifelong)
CO1	3	3	2	2	1	–	1	2
CO2	3	3	2	2	1	–	1	2
CO3	3	3	2	2	1	–	1	2
CO4	2	3	2	2	1	–	1	3

Correlation: 1 = Low, 2 = Medium, 3 = High; "–" = No correlation.

CO–PSO Mapping:

Course Outcomes	PSO1 (Robotics / Automation Systems)	PSO2 (Data Acquisition & Analytics)
CO1	1	2
CO2	2	2
CO3	1	2
CO4	1	3

Course Contents:

Unit 1: Workshop Arithmetic, Units and Measurement
Number operations, fractions and decimals; ratio, proportion and percentage; SI and other units used in workshops; unit conversion; significant figures and rounding; reading scales and simple measurement errors; speed/feed and material-quantity calculations.

Unit 2: Mensuration and Basic Trigonometry
Perimeter, area and volume of common shapes (rectangle, triangle, circle, cylinder, cone); surface area and weight of material from volume and density; angles, right-angle triangle and basic trigonometric ratios; simple applications in marking, taper and pitch calculations.

Unit 3: Basic Algebra and Graphs
Algebraic expressions, simple linear equations and formulae transposition; using formulae for gear ratio, cutting speed, RPM and scaling; plotting and reading simple graphs (straight-line relationship); interpolation in tables.

Unit 4: Introduction to Data and Basic Statistics
Collecting and tabulating shop-floor data; bar charts, pie charts and line graphs; average (mean), median, mode and range; introduction to the idea of variation and simple quality checks; reading a process data sheet.

Textbooks & References (Indian Authors / AICTE Prescribed):

1. Deepak Singh, “Mathematics-I”, AICTE Prescribed Textbook (Diploma, NEP 2020), ISBN 978-93-9150-5424 - available in Hindi (हिंदी) and other regional languages.
2. “कार्यशाला गणना एवं विज्ञान / Workshop Calculation & Science”, Khanna Book Publishing — Hindi (हिंदी) medium edition.
3. Garima Singh, “Mathematics-II”, AICTE Prescribed Textbook (Diploma, NEP 2020), ISBN 978-93-9150-5523 - available in Hindi (हिंदी).
4. B. V. Ramana, “Higher Engineering Mathematics” (selected basic topics), McGraw-Hill.

Suggested Tutorial / Sessional Assignments:

1. Convert a set of given measurements between mm, cm, m and inches.
2. Calculate the weight of a steel bar from its volume and density.
3. Find the area of a given sheet-metal development.
4. Calculate the RPM for a given cutting speed and diameter.
5. Work out the gear ratio for a given pair of gears.
6. Plot a straight-line graph from a given set of readings and read an in-between value.
7. Tabulate ten sample readings and find mean, median, mode and range.
8. Prepare a bar chart and a pie chart from the given production data.
9. Calculate taper and pitch for a given job.
10. Estimate material quantity and cost for a simple batch of parts.