COMPETENCY BASED CURRICULUM

DIPLOMA IN
AUTOMOBILE ENGINEERING

(Duration 3 Years)
NSQF Level – 5

Under
Haryana State Board of Technical Education

Developed By

Curriculum Development Center
National Institute of Technical Teachers Training & Research
(Ministry of Education, Government of India)
Sector - 26, Chandigarh, UT, India.

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PREFACE

Learning and learning experience are the foundation of any education system. Appropriateness of education and its useful implications stand on the platform of knowledge and skill. But the knowledge and skill cannot be quantified qualitatively without ensuring learning experience. Curriculum is the pathway to select and organise learning experience. It helps the teachers to provide tangible resources, goals and objectives to learners. Curriculum acts as a catalyst to stimulate creativity, innovation, ethics, values, responsibility and many human factors. Curriculum embodies rigour and high standards and creates coherence to empower learner to meet the industrial and societal needs. Curriculum is a central guide for a teacher to plan a standard based sequence for the instructional delivery.

The industrial revolution 4.0 has forced the technical education system to reinvent the curriculum to meet the human resource requirement of the industry. The data driven systems relying on the subjects like machine-learning, Artificial Intelligence, Data Science etc are literally forcing the technical education system to offer different subjects differently to address the emerging challenges. The non-linear way of learning now facilitates students to choose path of knowledge to skill or vice-versa. The bi-directional process requires innovative curriculum design and revision. Diploma programme is now more challenging than ever. The level of skill and knowledge demanded by industry from diploma holders are highly interdisciplinary at the same time address special need. Hence, there is a need to align the curriculum to National Skill Qualification Framework (NSQF).

National Education Policy, NEP-2020 has now opened up diversities for the education system to explore and exploit to make the education relevant. The policy emphasises to inculcate value, ethics, respect to culture and society etc along with industry ready knowledge and skill among the students. The interdisciplinary nature of curriculum, academic bank of credits and integration of technology in teaching-learning envisaged in NEP-2020 make it more challenging for curriculum development. NITTTR, Chandigarh has developed the art of curriculum development over 54 years of its existence. The expertise and experience available in the institute follow time-tested and acclaimed scientific methods to design/revise curriculum. The experienced faculty members entrusted with the curriculum development or revision activities are well-versed with NSQF, NEP and Outcome based education. I am happy to note that **Haryana State Board of Technical Education, Panchkula, Haryana** reposed their confidence on this expertise to develop **AICTE/NSQF/NEP 2020** aligned curriculum for the state. This documented curriculum is an outcome of meticulous planning and discussions among renowned experts of the subject through series of workshops. The effective implementation of this curriculum supported with quality instructional resources will go a long way in infusing the learning experience among learners to make them industry ready.

Director
National Institute of Technical Teachers Training & Research, Chandigarh

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1. SALIENT FEATURES

1.	Name	:	**Diploma in Automobile Engineering**
2.	Duration	:	**03 Years**
3.	Hours per week	:	**35**
4.	Entry Qualification	:	**10th Pass**
5.	Student Intake	:	**As per sanctioned strength**
6.	Pattern	:	**Semester**
7.	Scheme	:	**Multi Point Entry and Exit**
8.	NSQF Level	:	**5**
9.	Theory Practical Ratio	:	**37 : 63**
10.	Project Work	:	**Minor and Major Project**
11.	In-house/Industrial Training	:	**Mandatory after First and Second Year**

2. NSQF GUIDELINES

National Skill Qualification Framework has defined total Ten Levels. Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Fig.1: NSQF Domains

NSQF LEVEL - 3 COMPLIANCE

The NSQF level - 3 descriptor is as follows:

Process	• Person may carry out a job which may require limited range of activities routine and predictable.
Professional Knowledge	• Basic facts, process and principle applied in trade of employment.
Professional Skill	• Recall and demonstrate practical skill, routine and repetitive in narrow range of application.
Core Skill	• Communication written and oral, with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment.
Responsibility	• Under close supervision. Some responsibility for own work within defined limit.

Fig 2: NSQF Level – 3 Descriptor

Work requiring knowledge, skills and aptitudes at level 3 will be routine and predictable. Job holders will be responsible for carrying out a limited range of jobs under close supervision. Their work may require the completion of a number of related tasks. People carrying out these job roles may be described as "Semi skilled workers". Individuals in jobs which require level 3 qualifications will normally be expected to be able to communicate clearly in speech and writing and may be required to use arithmetic and algebraic processes. They will be expected to have previous knowledge and skills in the occupation and should know the basic facts, processes and principles applied in the trade for which they are qualified and be able to apply the basic skills of the trade to a limited range of straightforward jobs in the occupation.

They will be expected to understand what constitutes quality in their job role and more widely in the sector or sub-sector and to distinguish between good and bad quality in the context of the jobs they are given. Job holders at this level will be expected to carry out the jobs they are given safely and securely. They will work hygienically and in ways which show an understanding of environmental issues. This means that they will be expected to take responsibility for their own health and safety and that of fellow workers and, where appropriate, customers and/or clients. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social environment. They should be able to make a good contribution to team work.

NSQF LEVEL - 4 COMPLIANCE

The NSQF level-4 descriptor is given below:

Process	• Work in familiar, predictable, routine, situation of clear choice
Professional Knowledge	• Factual knowledge of field of knowledge or study.
Professional Skill	• Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts.
Core Skill	• Communication written and oral, with required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment.
Responsibility	• Responsibility for own work and learning.

Fig 3: NSQF Level – 4 Descriptor

Work requiring knowledge, skills and aptitudes at level 4 will be carried out in familiar, predictable and routine situations. Job holders will be responsible for carrying out a range of jobs, some of which will require them to make choices about the approaches they adopt. They will be expected to learn and improve their practice on the job. People carrying out these jobs may be described as "skilled workers". Individuals in jobs which require level 4 qualifications should be able to communicate clearly in speech and writing and may be required to use arithmetic and algebraic processes. They will be expected to have previous knowledge and skills in the occupation in which they are employed, to appreciate the nature of the occupation and to understand and apply the rules which govern good practice. They will be able to make choices about the best way to carry out routine jobs where the choices are clear.

They will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their job roles. Job holders at this level will be expected to carry out their work safely and securely and take full account of the health and safety on colleagues and customers. They will work hygienically and in ways which show an understanding of environmental issues. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social and political environment. They should be able to guide or lead teams on work within their capability.

NSQF LEVEL - 5 COMPLIANCE

The NSQF level-5 description is given below:

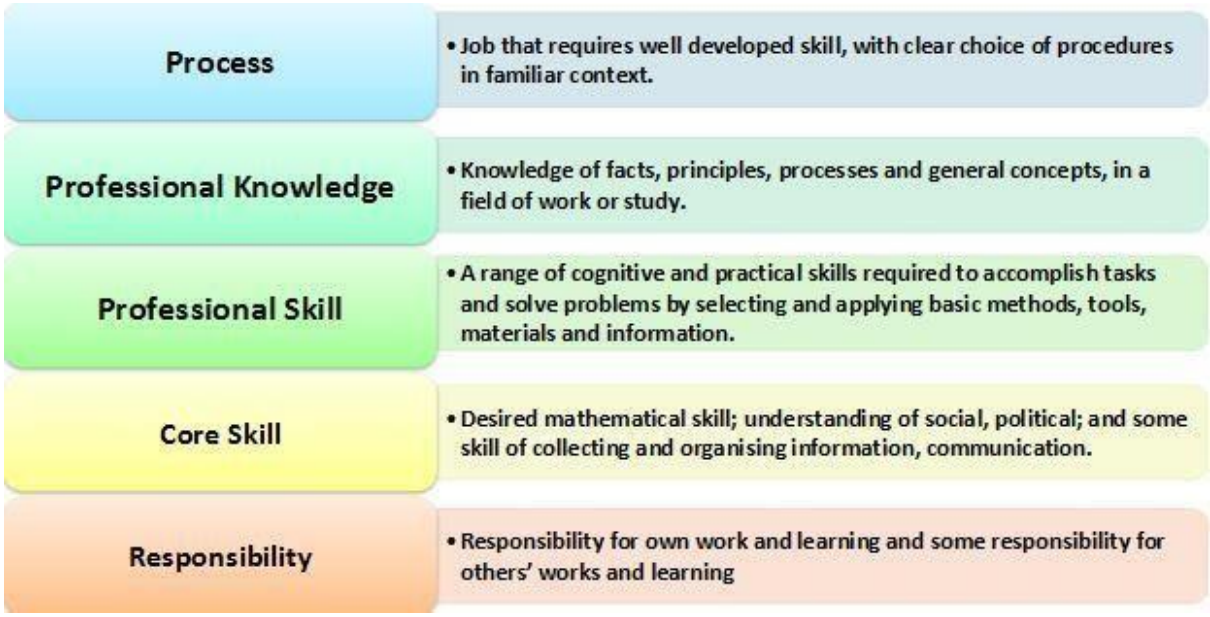

Fig 4: NSQF Level – 5 Descriptor

Work requiring knowledge, skills and aptitudes at level 5 will also be carried out in familiar situations, but also ones where problems may arise. Job holders will be able to make choices about the best procedures to adopt to address problems where the choices are clear. Individuals in jobs which require level 5 qualifications will normally be responsible for the completion of their own work and expected to learn and improve their performance on the job. They will require well developed practical and cognitive skills to complete their work. They may also have some responsibility for others' work and learning. People carrying out these jobs may be described as "fully skilled workers" or "supervisors".

Individuals employed to carry out these jobs will be expected to be able to communicate clearly in speech and writing and may be required to apply mathematical processes. They should also be able to collect and organise information to communicate about the work. They will solve problems by selecting and applying methods, tools, materials and information. They will be expected to have previous knowledge and skills in the occupation, and to know and apply facts, principles, processes and general concepts in the occupation. They will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their work. They will be expected to operate hygienically and in ways which show an understanding of environmental issues. They will take account of health and safety issues as they affect the work they carry out or supervise.

In working with others, they will be expected to conduct themselves in ways which show an understanding of the social and political environment.

3. NATIONAL EDUCATION POLICY (NEP) - 2020

NEP 2020 aims at a comprehensive holistic education to develop all capacities of human beings - intellectual, aesthetic, social, physical, emotional, and moral - in an integrated manner. A holistic arts education will help develop well-rounded individuals that possess: critical 21st century capacities in fields across the arts, humanities, languages, sciences, social sciences, and professional, technical, and vocational fields; an ethic of social engagement; soft skills, such as communication, discussion and debate; and rigorous specialization in a chosen field or fields. Such a holistic education shall be, in the long term, the approach of all undergraduate programmes, including those in professional, technical, and vocational disciplines.

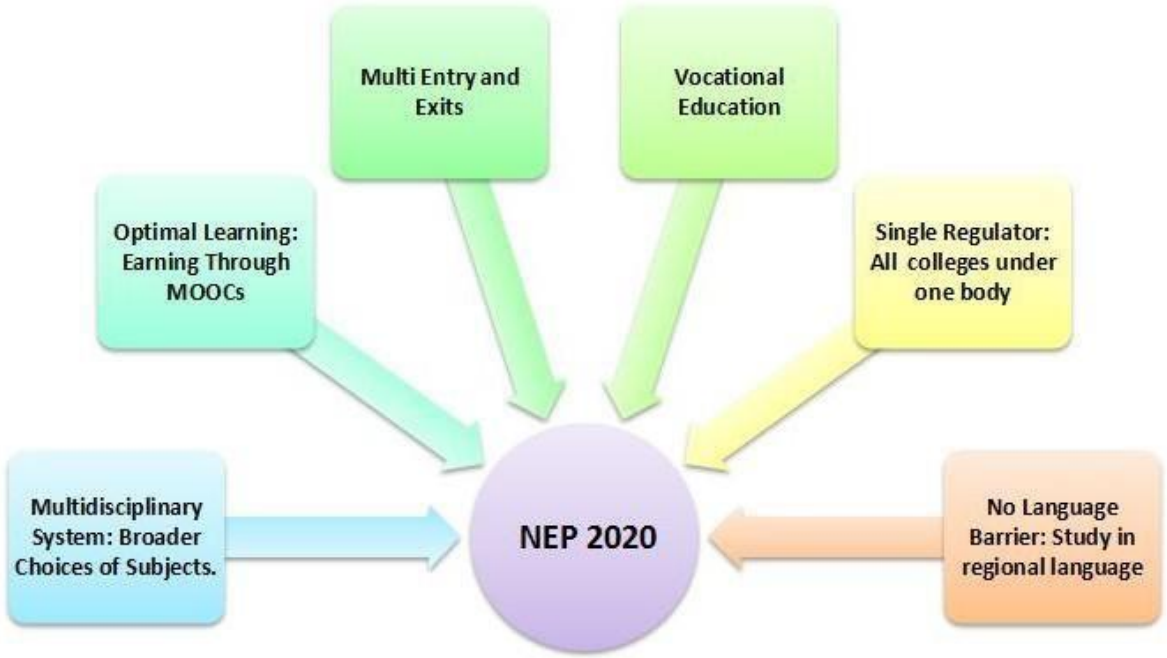

Fig 5: NEP 2020

Flexibility in curriculum and novel and engaging course options will be on offer to students, in addition to rigorous specialisation in a subject or subjects. Pedagogy for courses will strive for significantly less rote learning and an increased emphasis on communication, discussion, debate, research, and opportunities for cross-disciplinary and interdisciplinary thinking. The flexible and innovative curriculum shall emphasize on offering credit-based courses and projects in the areas of community engagement and service, environmental education and value-based education. as part of a holistic education, students will be provided with opportunities for internships with local industry, businesses, artists, crafts persons, villages and local communities, etc., as well as

research internships with faculty and researchers at their own or other HEIs or research institutions, so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability.

Effective learning requires relevant curriculum, engaging pedagogy, continuous formative assessment and adequate student support. The curriculum must be updated regularly aligning with the latest knowledge requirements and shall meet specified learning outcomes. High-quality pedagogy is then necessary to successfully impart the curricular material to students; pedagogical practices determine the learning experiences that are provided to students - thus directly influencing learning outcomes. The assessment methods have to be scientific and test the application of knowledge. Higher Education Institutes should move to a criterion-based grading system that assesses student achievement based on the learning goals for each programme, making the system fairer and outcomes more comparable. HEIs should also move away from high-stakes examinations towards more continuous and comprehensive evaluation.

4. DIPLOMA PROGRAMME OUTCOMES

The programme outcomes are derived from five domains of NSQF Level namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this programme, the student will be able to:

PO1: Perform tasks in limited range of activities, familiar situation with clear choice of procedures.

PO2: Acquire knowledge of principles and processes in the field of Automobile Engineering.

PO3: Develop skills to accomplish quality tasks and solve problems using methods, tools, materials and information**.**

PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.

PO5: Take the responsibility of own work and supervise others work.

PO6: Select multidisciplinary subjects of own interest from broader choices.

PO7: Perform Self Learning through Massive Open Online Courses (MOOCs).

5. DERIVING CURRICULUM SUBJECT AREAS FROM DIPLOMAPROGRAMME OUTCOMES

The following curriculum subject areas have been derived from Programme outcomes:

Sr. No.	Programme Outcomes	Curriculum Subject Areas
1.	Perform tasks in limited range of activities, familiar situation with clear choice of procedures.	• Basics of Automobile Engineering • General Workshop Practice • Workshop Practice I • Mechanical Workshop Practice –I • Mechanical Workshop Practice II • Automobile Workshop Practice • Engineering Graphics • Auto Engineering Drawing • Computer Aided Drafting for Automobile Engineering • Applied Mechanics • Applied Physics - I • Applied Physics - II • Applied Chemistry • Strength of Materials • Basics of Thermodynamics, Hydraulics and Pneumatics • Materials and Metallurgy • Auto Professional and Driving Practice - I • Auto Professional and Driving Practice – II • Entrepreneurship Development & Management
2.	Acquire knowledge of principles and processes in the field of Automobile Engineering.	• Basics of Automobile Engineering • Workshop Technology-I • Automobile Workshop Practice • Applied Mechanics • Applied Physics - I • Applied Physics – II • Strength of Materials • Basics of Thermodynamics, Hydraulics and Pneumatics

		• Auto Engineering Drawing • Computer Aided Drafting for Automobile Engineering • Materials and Metallurgy • CNC Machines and Advanced Manufacturing Processes • Auto Engine – I • Auto Engine - II • Chassis, Body and Transmission – I • Chassis, Body and Transmission – II • Auto Professional and Driving Practice - I • Auto Professional and Driving Practice - II • Minor Project Work • Major Project • MVA and Garage Management
3.	Develop skills to accomplish quality tasks and solve problems using methods, tools, materials and information**.**	• General Workshop Practice • Workshop Practice I • Mechanical Workshop Practice –I • Automobile Workshop Practice • Mechanical Workshop Practice II • Engineering Graphics • Mechanical Engg Drawing I • Auto Engineering Drawing • Industrial / In –House Training. • Basics of Thermodynamics, Hydraulics and Pneumatics • Materials and Metallurgy • CNC Machines and Advanced Manufacturing Processes • Computer Aided Drafting for

		Automobile Engineering • Auto Professional and Driving Practice - I • Auto Professional and Driving Practice - II • Minor Project Work • Major Project • Entrepreneurship Development & Management
4.	Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• English and Communication Skills – I • English and Communication Skills - II • Applied Mathematics – I • Applied Mathematics – II • Fundamentals of IT • Environmental Studies & Disaster Management • Computer Aided Drafting for Automobile Engineering • Minor Project Work • Major Project • MVA and Garage Management • Entrepreneurship Development & Management
5.	Take the responsibility of own work and supervise others work.	• General Workshop Practice • Workshop Practice I • Mechanical Workshop Practice –I • Mechanical Workshop Practice II • Industrial / In-House Training • CNC Machines and Advanced Manufacturing Processes • MVA and Garage

		Management • Entrepreneurship Development & Management • Major Project
6.	Select multidisciplinary subjects of own interest from broader choices.	• Multidisciplinary Elective • Open Elective – (MOOCs/Offline) • Programme Elective I • Minor Project Work • Major Project • Programme Elective II
7.	Perform Self Learning through Massive Open Online Courses (MOOCs).	• Open Elective – (MOOCs/Offline) • Multidisciplinary Elective (MOOCs/Offline)

FIRST YEAR
NSQF LEVEL - 3

6. DIPLOMA PROGRAMME STUDY AND EVALUATION SCHEME
FIRST YEAR

FIRST SEMESTER :

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
1.1	*English and Communication Skills –I	2	2	2+1=3	40	40	80	60	60	120	200
1.2	*Applied Mathematics I	4	-	4+0=4	40	-	40	60	-	60	100
1.3	*Applied Physics-I	2	2	2+1=3	40	40	80	60	60	120	200
1.4	*Engineering Graphics	-	6	0+3=3	-	40	40	60	-	60	100
1.5	*Fundamentals of IT	2	4	2+2=4	40	40	80	60	60	120	200
1.6	Basics of Automobile Engineering	2	-	2+0=2	40	-	40	60	-	60	100
1.7	*Environmental Studies & Disaster Management	2	-	2+0=2	40	-	40	60	-	60	100
1.8	*General Workshop Practice	-	6	0+3 = 3	-	40	40	-	60	60	100
#Student Centred Activities (SCA)		-	1	-	-	-	-	-	-	-	-
Total		**14**	**21**	**24**	**240**	**200**	**440**	**420**	**240**	**660**	**1100**

* Common with other diploma programmes

Student Centred Activities will comprise of co-curricular activities like extension lectures on Constitution of India, etc, Games, Yoga, Human Values & Ethics, Knowledge of Indian System, Hobby Clubs e.g. Photography etc., Seminars, Declamation Contests, Educational Field Visits, NCC, NSS, Cultural Activities and Self-study etc.

SECOND SEMESTER:

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
2.1	*Applied Mathematics II	4	-	4+0=4	40	-	40	60	-	60	100
2.2	*Applied Physics-II	2	2	2+1=3	40	40	80	60	60	120	200
2.3	*Applied Chemistry	3	2	3+1=4	40	40	80	60	60	120	200
2.4	**Applied Mechanics	3	2	3+1=4	40	40	80	60	60	120	200
2.5	**Mechanical Engineering Drawing-I	-	6	0+3=3	-	40	40	60	-	60	100
2.6	**Workshop Technology -I	3	-	3+0=3	40	-	40	60	-	60	100
2.7	**Workshop Practice- I	-	6	0+3=3	-	40	40	-	60	60	100
#Student Centred Activities (SCA)		-	2	-	-	-	-	-	-	-	-
Total		**15**	**20**	**24**	**200**	**200**	**400**	**360**	**240**	**600**	**1000**

* Common with other Diploma Courses

** Common with diploma in Mechanical Engineering

Student Centred Activities will comprise of co-curricular activities like extension lectures on Constitution of India, etc, Games, Yoga, Human Values & Ethics, Knowledge of Indian System, Hobby Clubs e.g. Photography etc., Seminars, Declamation Contests, Educational Field Visits, NCC, NSS, Cultural Activities and Self-study etc.

Summer Industrial/In-house Training : After 2nd semester, students shall undergo Summer Training of minimum 4 Weeks

7. HORIZONTAL AND VERTICAL ORGANIZATION OF SUBJECTS

Sr. No.	Subjects	Hours Per Week	
		First Semester	Second Semester
1.	English and Communication Skills - I	4	-
2.	Applied Physics	4	4
3.	Applied Chemistry	-	5
4.	Engineering Graphics	6	-
5.	Applied Mathematics	4	4
6.	Basics of Automobile Engineering	2	
7.	General Workshop Practice	6	-
8.	Fundamentals of IT	6	-
9.	Applied Mechanics	-	5
10.	Workshop Technology I	-	3
11	Workshop Practice I	-	6
12	Environmental Studies & Disaster Management	2	-
13	Mechanical Engg. Drawing I	-	6
14	Student Centred Activities	1	2
	Total	**35**	**35**

8. COMPETENCY PROFILE AND EMPLOYMENT OPPORTUNITIES

In government and private sectors related to Automobile Engineering, "Semi Skilled workers" are required to carry out a limited range of predictable tasks under close supervision. They are normally expected to communicate clearly in speech and along with knowledge of arithmetic and algebraic processes. They should know the basic facts, processes and principles applied in limited area of Automobile Engineering.

The NSQF Level – 3 pass out students are expected to recall and demonstrate practical routine and repetitive skills, in narrow range of Automobile Engineering applications. They are expected to understand what constitutes quality in their job role. They are also expected to carry out the jobs given to them safely and securely. They have wide scope to work as semi-skilled employee on wage basis in following industries:

i) Automobile industry
ii) Auto ancillary industry

They also have good avenues to work in organizations such as State transport authorities, garages of municipal corporations and other public/private sector undertakings, maintenance department of heavy earth moving equipment, repair and maintenance of tractor and agriculture equipment in service centre.

They have wide scope in establishing small startups in the area of Marketing and Sales, Manufacturing Units and Repair and Maintenance units etc.

9. PROGRAMME OUTCOMES

The programme outcomes are derived from five domains of NSQF Level – 3 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this programme, the student will be able to:

PO1: Carry out a task which may require limited range of predictable activities.

PO2: Acquire knowledge of basic facts, process and principles related to Automobile Engineering for employment.

PO3: Demonstrate practical skill in narrow range of Automobile Engineering applications.

PO4: Communicate in written and oral, with minimum required clarity along with skill of basic arithmetic and algebraic principles, personal banking and basic understanding of social and natural environment.

PO5: Perform task under close supervision with some responsibility for own work within defined limit.

10. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be Assessed	Assessment Criteria for the Course Outcomes
PO1: Carry out a task which may require limited range of predictable activities.	• Identify tools, equipment and materials used in preparing jobs. • Take measurements with the help of basic measuring tools/equipment. • Select materials, tools, and sequence of operations to make a job as per given specifications/drawing. • Prepare simple jobs independently and inspect the same. • Use safety equipment and Personal Protection Equipment (PPE). • Maintain good housekeeping practices. • Classify various types of vehicle layouts. • Identify various systems of an automobile. • Explain constructional details of vehicle body. • Describe the necessity of engine in an automobile. • Enlist various vehicle and road safety systems. • Identify physical quantities, select their units and make measurements with accuracy. • Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications. • Differentiate between types of waves and their motion. • Illustrate laws of reflection and refraction of light. • Demonstrate competency in phenomena of electrostatics and electricity.

	• Classify the elements into metals, non-metals and metalloids. • Explain the extraction of metals from ores, their mechanical properties and modification of properties by alloy formation. • Classify fuels and lubricants and apply them in different engineering applications. • Identify the polymeric materials, assess their properties and design suitable polymeric materials for current and future applications. • Apply effective methods for corrosion prevention. • Draw free body diagrams.by analyzing different types of forces acting on a body. • Determine the resultant of coplanar concurrent forces. • Solve problems by using principle of moment. • Calculate the least force required to maintain equilibrium on an inclined plane. • Determine the centroid/centre of gravity of plain and composite laminar and solid bodies. • Determine velocity ratio, mechanical advantage and efficiency of simple machines.
PO2: Acquire knowledge of basic facts, process and principles related to Automobile Engineering for employment.	• Classify various types of vehicle layouts. • Identify various systems of an automobile • Explain constructional details of vehicle body • Describe the necessity of engine in an automobile. • Enlist various vehicle and road safety systems.

	• Identify physical quantities, select their units and make measurements with accuracy. • Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications. • Demonstrate competency in phenomena of electrostatics and electricity. • Characterize properties of material to prepare new materials for various technical applications. • Draw free body diagrams.by analyzing different types of forces acting on a body. • Determine the resultant of coplanar concurrent forces. • Solve problems by using principle of moment. • Calculate the least force required to maintain equilibrium on an inclined plane. • Determine the centroid/centre of gravity of plain and composite laminar and solid bodies. • Determine velocity ratio, mechanical advantage and efficiency of simple machines. • Classify various types of hand tools. • Explain working principle of vernier caliper and micrometer for measurement. • Explain the parts of lathe and their functions. • Select material and tool geometry for cutting tools on lathe. • Explain geometry of single point tool, various types of lathe tools and tool materials.

	• Explain the working of drilling and boring process. • Explain the nomenclature of a drill and boring tools. • Select most appropriate process, electrodes, various process parameters for a job. • Explain principle of gas welding and arc welding process. • Select a cutting fluid for an operation.
PO3: Demonstrate Practical skill in narrow range of Automobile Engineering applications.	• Elaborate scientific work, energy and power, forms of friction and solve problems related to them. • Comprehend properties of matter and effect of temperature on various matter and phenomenon. • Characterize properties of material to prepare new materials for various engineering applications. • Demonstrate the use of physical principles and analysis in various technical fields. • Demonstrate a strong foundation on Modern Physics to use at various technical applications. • Identify tools, equipment and materials used in preparing jobs. • Take measurements with the help of basic measuring tools/equipment. • Select materials, tools, and sequence of operations to make a job as per given specifications/drawing. • Prepare simple jobs independently and inspect the same. • Use safety equipment and Personal Protection Equipment (PPE). • Maintain good housekeeping practices.

	• Draw Orthographic views of different objects viewed from different angles. • Draw and interpret sectional views of an object which are otherwise not visible in normal view. • Draw Isometric views of different solids and develop their surfaces. • Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances /fittings. • Draw orthographic views of different objects by using basic commands of AutoCAD.
PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• Identify the nuances of Communication, both Oral and Written. • Acquire knowledge of the meaning of communication, communication process and speaking skills. • Acquire enhanced vocabulary and in-depth understanding of Grammatical Structures and their usage in the communication. • Communicate effectively with an increased confidence to read, write and speak in English language fluently. • Comprehend the importance of sustainable ecosystem. • Clarify interdisciplinary nature of environmental issues. • Describe corrective measures for the abatement of pollution. • Identify the role of non-conventional energy resources in environmental protection. • Recognize various types of disasters.

	• Explain the basic components of Computers, Internet and issues of abuses/ attacks on information and computers. • Handle the computer/laptop/mobiles/ Internet Utilities and Install/Configure OS • Assemble a PC and connect it to external devices. • Manage and Use Office practiced Automation Tools. • Develop worksheets and Prepare presentations. • Understand the geometric shapes used in engineering problems by Co-ordinate Geometry and Trigonometry. • Formulate engineering problems into mathematical formats with the use matrices, co-ordinate geometry and trigonometry. • Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem. • Explore the idea of location, graph, and linear relationships between two variables. • Formulate the engineering problems into mathematical format with the use of differential equations and differential. • Use the differentiation and Integration in solving various Mathematical and Engineering problems. • Calculate the approximate area under a curve by applying integration and numerical methods.

	• Discuss the purposes of measures of central tendency and calculate the measures of central tendency (mode, median, mean) for a set of data. • Learn about basic fundamentals about • MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software
PO5: Perform task under close supervision with some responsibility for own work within defined limit.	• Take measurements with the help of basic measuring tools/equipment. • Select materials, tools, and sequence of operations to make a job as per given specifications/drawing. • Prepare simple jobs independently and inspect the same. • Use safety equipment and Personal Protection Equipment (PPE). • Maintain good housekeeping practices.

11. SUBJECTS & DETAILED CONTENTS

FIRST SEMESTER

1.1	English and Communication Skills –I	25-27
1.2	Applied Mathematics I	28-31
1.3	Applied Physics-I	32-35
1.4	Engineering Graphics	36-39
1.5	Fundamentals of IT	40-43
1.6	Basics of Automobile Engineering	44-45
1.7	Environmental Studies and Disaster Management	46-48
1.8	General Workshop Practice	49-53

1.1 ENGLISH & COMMUNICATION SKILLS – I

L	P
2	2

RATIONALE

Language as the most commonly used medium of self-expression remains indispensable in all spheres of human life –personal, social and professional. This course is intended to break fresh ground in teaching of Communicative English as per the requirements of National Skill Quality Framework. This course is designed to help students to acquire the concept of communication and develop an ability or skills to use them effectively to communicate with the individuals and community.

COURSE OUTCOMES

After undergoing this subject, the students will be able to:

CO1: Identify the nuances of Communication, both Oral and Written.

CO2: Acquire knowledge of the meaning of communication, communication process and speaking skills.

CO3: Acquire enhanced vocabulary and in-depth understanding of Grammatical Structures and their usage in the communication.

CO4: Communicate effectively with an increased confidence to read, write and speak in English language fluently.

DETAILED CONTENTS

UNIT I

Reading

1.1 Techniques of reading: Skimming and Scanning

1.2 Extensive and Intensive Reading: Textual Study

1.3 Homecoming – R.N. Tagore

1.4 Life Sketch of Sir Mokshagundam Visvesvarayya

1.5 Life Sketch of Dr. Abdul Kalam

1.6 Narayan Murthy’s speech at LBSNA, Dehradun

UNIT II

Fundamentals of Communication

2.1 Concept and Process of Communication

2.2 Types of Communication (Verbal Communication)

2.3 Barriers to Communication
2.4 Speaking Skill: Significance and essentials of Spoken Communication
2.5 Listening Skill: Significance and essentials of Listening

UNIT III

Grammar and Usage

3.1 Nouns
3.2 Pronouns
3.3 Articles
3.4 Verbs(Main and Auxiliary)
3.5 Tenses

UNIT IV

Writing Skills

4.1 Significance, essentials and effectiveness of Written Communication
4.2 Notice Writing
4.3 Official Letters and E-mails.
4.4 Frequently-used Abbreviations used in Letter-Writing
4.5 Paragraph Writing
4.6 Netiquettes

PRACTICAL EXERCISES

1. Reading

Reading Practice of lessons in the Lab Activity classes.

i. Comprehension exercises of unseen passages along with the lessons prescribed.
ii. Vocabulary enrichment and grammar exercises based on the selected readings.
iii. Reading aloud Newspaper headlines and important articles.

2. Fundamentals of Communication

i. Introducing oneself, others and leave- taking(talking about yourself)
ii. Just a minute (JAM) sessions: Speaking extempore for one minute on given topics
iii. Situational Conversation: Offering-Responding to offers; Congratulating; Apologizing and Forgiving; Complaining; Talking about likes and dislikes, Self-introduction Mock Interviews

3. Grammar and Usage

i. Written and Oral Drills will be undertaken in the class to facilitate holistic linguistic competency among learners.
ii. Exercises on the prescribed grammar topics.

4. Writing Skills

i. Students should be given Written Practice in groups so as to inculcate team-spirit and collaborative learning .

ii. Group exercises on writing paragraphs on given topics.

iii. Opening an e-mail account, receiving and sending emails

RECOMMENDED BOOKS

1) Alvinder Dhillon and Parmod Kumar Singla, "Text Book of English and Communication Skills Vol – 2", M/S Abhishek Publications, Chandigarh.
2) V Sasikumar & PV Dhamija, "Spoken English", Tata MC Graw Hills, New Delhi, Second Edition.
3) JK Gangal, "A Practical Course in Spoken English", PHI Learning Pvt. Ltd., New Delhi.
4) NK Aggarwal and FT Wood, "English Grammar, Composition and Usage", Macmillan Publishers India Ltd., New Delhi.
5) RC Sharma and Krishna Mohan, "Business Correspondence & Report writing", Tata MC Graw Hills, New Delhi, Fourth Edition.
6) Kavita Tyagi & Padma Misra, "Professional Communication", PHI Learning Pvt. Ltd., New Delhi.
7) Nira Konar, "Communication Skills for professionals", PHI Learning Pvt. Ltd., New Delhi.
8) Krishna Mohan & Meera Banerji, "Developing Communication Skills", Macmillan Publishers India Ltd., New Delhi, Second Edition
9) M. Ashraf Rizwi, "Effective Technical Communication", Tata MC Graw Hills, New Delhi.
10) Andrea J Rutherfoord, "Basic Communication Skills for Technology", Pearson Education, New Delhi.

INSTRUCTIONAL STRATEGY

This is practice based subject and topics taught in the class should be practiced as exercises in the Lab regularly for development of communication skills in the students. The students should be involved in activities to enhance their personality skills. This subject contains four units of equal weightage.

1.2 APPLIED MATHEMATICS - I

L	P
4	-

RATIONALE

Contents of this course provide fundamental base for understanding engineering problems and their solution algorithms. Contents of this course will enable students to use basic tools like logarithm, binomial theorem, matrices, t-ratios and co-ordinates for solving complex engineering problems with exact solutions in a way which involve less computational task. By understanding the logarithm, they will be able to make long calculations in short time and it is also a pre-requisite for understanding Calculus.

COURSE OUTCOMES

After undergoing this subject, the students will be able to:

CO1: Illustrate the geometric shapes used in engineering problems by Co-ordinate Geometry and Trigonometry.

CO2: Formulate engineering problems into mathematical formats with the use matrices, co-ordinate geometry and trigonometry

CO3: Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem.

CO4: Explore the idea of location, graph, and linear relationships between two variables.

CO5: Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

DETAILED CONTENTS

UNIT I

Algebra

1.1 Complex Numbers: definition of complex number, real and imaginary parts of a complex number, Polar and Cartesian Form and their inter conversion, Conjugate of a complex number, modulus and amplitude, addition subtraction, multiplication and division of complex numb

1.2 Logarithms and its basic properties

UNIT II

Binomial Theorem, Determinants and Matrices

2.1 Meaning of ${}^{n}P_{r}$ & ${}^{n}C_{r}$ (mathematical expression). Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion up to 3 terms - without proof), first binomial approximation with application to engineering problems.

2.2 Determinants and Matrices – Evaluation of determinants (upto 2^{nd}order), solution of equations (upto 2 unknowns) by Crammer's rule, definition of Matrices and its types, addition, subtraction and multiplication of matrices (upto 2^{nd} order).

UNIT III

Trigonometry

3.1 Concept of angle, measurement of angle in degrees, grades, radians and their conversions.

3.2 T-Ratios of Allied angles (without proof), Sum, Difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa

3.3 Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.

UNIT-IV

Co-ordinate Geometry

4.1 Cartesian and Polar co-ordinates (two dimensional), Distance between two points, mid-point, centroid of vertices of a triangle.

4.2 Slope of a line, equation of straight line in various standards forms (without proof); (slope intercept form, intercept form, one-point form, two-point form, symmetric form, normal form, general form), intersection of two straight lines, concurrency of lines, angle between straight lines, parallel and perpendicular lines, perpendicular distance formula, conversion of general form of equation to the various forms.

UNIT V

Geometry of Circle and Software

Circle

5.1 General equation of a circle and its characteristics. To find the equation of a circle, given:

i. Centre and radius
ii. Three points lying on it
iii. Coordinates of end points of a diameter

Software

5.2 **MATLAB Or SciLab software –** Theoretical Introduction, MATLAB or Scilab as Simple Calculator (Addition and subtraction of values –Trigonometric and Inverse Trigonometric functions) – General Practice

RECOMMENDED BOOKS

1. R. D. Sharma, "Applied Mathematics – I & II for Diploma Courses", Dhanpat Rai Publications.
2. "Mathematics for Class XI", NCERT Publication, New Delhi.
3. "Mathematics for Class XII", NCERT Publication, New Delhi.
4. H. K Dass, "Applied Mathematics for Polytechnics", CBS Publishers & Distributers.
5. A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics – I", CBS Publisher, New Delhi.
6. A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics –II", CBS Publisher, New Delhi.
7. G. B. Thomas, R. L. Finney, "Calculus and Analytic Geometry", Addison Wesley, Ninth Edition.
8. B S Grewal, "Elementary Engineering Mathematics", Khanna Publishers, Delhi, Thirty-fifth Edition.
9. R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, New Delhi, Second Edition, 2003.
10. SS Sabharwal & Dr Sunita Jain, "Applied Mathematics Vol. I & II", Eagle Parkashan, Jalandhar.
11. S Kohli, "Engineering Mathematics Vol. I & II", IPH, Jalandhar.
12. Reena Garg & Chandrika Prasad, "Advanced Engineering Mathematics", Khanna Publishing House, New Delhi
13. R. Pratap, "Getting Started with MATLAB 7", Oxford University Press, Seventh Edition.
14. E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://swayam.gov.in
2. https://www.scilab.org

INSTRUCTIONAL STATREGY

This is theoretical subject and contains five units of equal weight age.

Basic elements of algebra, trigonometry and co-ordinate geometry can be taught in the light of their applications in the field of engineering and technology. By laying more emphasis on applied part, teacher can also help in providing a good continuing education base to the students. Students need to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics related to Algebra, Trigonometry and Coordinate Geometry that the industry requires. Examples to be used should be related to engineering.

Useful software MATLAB or open source software SciLab can be taught theoretically by books/online literatures and basic operations can be shown practically with practical software laboratory or small mobile apps of these software or authentic Trial version of MATLAB/ SciLab software. Students should be able to relate to the actual use of these examples and the way mathematical calculations will help them in doing their job.

1.3 APPLIED PHYSICS-I

L	P
2	2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various fields of technical are given prominence in the course content.

COURSE OUTCOMES

After completing this subject, student should be able to:

CO1: Identify physical quantities, select their units for use in engineering solutions, and make measurements with accuracy.

CO2: Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications.

CO3: Elaborate scientific work, energy and power, forms of friction and solve problems related to them.

CO4: Comprehend properties of matter and effect of temperature on various matter and phenomenon.

CO5: Demonstrate the use of physical principles and analysis in various fields of technology.

DETAILED CONTENTS

UNIT I

Unit and Dimensions

1.1 Definition of Physics, physical quantities- fundamental and derived

1.2 Units: fundamental and derived

1.3 System of units: CGS, FPS, MKS, SI

1.4 Dimension, dimensional formulae and SI units of physical quantities-distance, displacement, area, volume, density, velocity, acceleration, linear momentum, force, impulse, work, power, energy, pressure, surface tension, stress, strain)

1.5 Dimensional equations, principle of homogeneity of dimensional equation

1.6 Application of dimensional analysis: checking the correctness of physical equation, conversion of system of unit (force, work, acceleration)

UNIT II

Force and Motion

2.1 Scalar and vector quantities– definition and examples, representation of vector, types of vector (unit vector, position vector, co-initial vector, collinear vector, co-planar vector)

2.2 Vector algebra- addition of vectors, Triangle & Parallelogram law (statement and formula only),

2.3 Scalar and vector product (statement and formula only)

2.4 Force and its units, resolution of force (statement and formula only)

2.5 Newton's laws of motion (statement and examples)

2.6 Linear momentum, Law of conservation of linear momentum (statement and examples), Impulse

2.7 Circular motion: definition of angular displacement, angular velocity, angular acceleration, frequency, time period; Relation between linear and angular velocity, centripetal and centrifugal forces (definition and formula only), application of centripetal force in banking of road

2.8 Rotational motion: definition with examples

2.9 Definition of torque, angular momentum, moment of inertia and its physical significance

UNIT III

Work, Power and Energy

3.1 Work- definition, symbol, formula and SI unit, types of work (zero work, positive work and negative work) with example

3.2 Friction– definition and its simple daily life applications

3.3 Power- definition, formula and units

3.4 Energy- definition and its SI unit, examples of transformation of energy.

3.5 Kinetic energy- definition, examples, formula and its derivation

3.6 Potential energy- definition, examples, formula and its derivation

3.7 Law of conservation of mechanical energy for freely falling bodies (with derivation)

3.8 Simple numerical problems based on formula of Power and Energy

UNIT IV

Properties of Matter

4.1 Elasticity and plasticity- definition, deforming force, restoring force, example of elastic and plastic body

4.2 Definition of stress and strain, Hooke's law, modulus of elasticity

4.3 Pressure- definition, atmospheric pressure, gauge pressure, absolute pressure, Pascal's law

4.4 Surface tension- definition, SI unit, applications of surface tension, effect of temperature on surface tension

4.5 Viscosity: definition, unit, examples, effect of temperature on viscosity

UNIT V

Heat and Temperature

5.1 Definition of heat and temperature (on the basis of kinetic theory)

5.2 Difference between heat and temperature

5.3 Principle and working of mercury thermometer

5.4 Modes of transfer of heat- conduction, convection and radiation with examples.

5.5 Properties of heat radiation

5.6 Different scales of temperature and their relationship

PRACTICAL EXERCISES

1. Familiarization of measurement instruments and their parts (for example - vernier calliper, screw gauge, spherometer, travelling microscope etc.), and taking a reading. (compulsory to all students)
2. To find diameter of solid cylinder using a vernier calliper
3. To find internal diameter and depth of a beaker using a vernier calliper and hence find its volume.
4. To find the diameter of wire using screw gauge
5. To find thickness of paper using screw gauge.
6. To determine the thickness of glass strip using a spherometer
7. To determine radius of curvature of a given spherical surface by a spherometer.
8. To verify parallelogram law of force
9. To determine the atmospheric pressure at a place using Fortin's Barometer
10. To determine force constant of spring using Hooke's law
11. Measuring room temperature with the help of thermometer and its conversion in different scale.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XI (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. Dr. HH Lal, "Applied Physics, Vol. I and Vol. II", TTTI Publications, Tata McGraw Hill, Delhi.
3. AS Vasudeva, "Applied Physics – I", Modern Publishers, Jalandhar.
4. R A Banwait, "Applied Physics – I", Eagle Prakashan, Jalandhar.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/ NITTTR.

6. C. L. Arora, “Practical Physics”, S Chand Publication.

SUGGESTED WEBSITES

1. http://swayam.gov.in
2. The Physics Classroom
3. https://www.khanacademy.org/science/physics

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students. Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

1.4 ENGINEERING GRAPHICS

L	P
-	6

RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawings is their day to day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Draw Orthographic views of different objects viewed from different angles.

CO2: Draw and interpret sectional views of an object which are otherwise not visible in normal view.

CO3: Draw Isometric views of different solids and develop their surfaces.

CO4: Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances /fittings.

CO5: Draw orthographic views of different objects by using basic commands of AutoCAD.

DETAILED CONTENTS

UNIT I

1. Introduction to Engineering Drawing and Graphics

1.1 Introduction to use and care of drawing instruments, drawing materials, layout and sizes of drawing sheets and drawing boards.

1.2 Symbols and conventions-

a) Conventions of Engineering Materials, Sectional Breaks and Conventional lines.

b) Civil Engineering Sanitary fitting symbols

c) Electrical fitting symbols for domestic interior installations.

1.3 Geometrical construction-geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagons, pentagons bisecting a line and arc , division of line and circle with the help of drawing instruments.

2. Technical Lettering of Alphabet and Numerals

Definition and classification of lettering, Free hand (of height of 5,8,12 mm) and instrumental lettering (of height 20 to 35 mm) : upper case and lower case, single and double stroke, vertical and inclined (Gothic lettering) at 75 degree to horizontal and with suitable height to width ratio 7:4.

3. Dimensioning

3.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions).

3.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., countersunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches.

4. Scales

4.1 Scales –Needs and importance (theoretical instructions), Type of scales, Definition of Representative Fraction (R.F.) and Length of Scale.

4.2 To draw/construct plain and diagonal scales.

UNIT II

1. Orthographic Projections

1.1 Theory of orthographic projections (Elaborate theoretical instructions).

1.2 Three views of orthographic projections of different objects of given pictorial view of a block in 1st and 3rd angle.

1.3 Projection of Points in different quadrant

1.4 Projection of Straight Line (1^{st} angle)

i. Line parallel to both the planes.

ii. Line perpendicular to any one of the reference plane and parallel to others

iii. Line inclined to any one of the references and parallel to another plane.

1.5 Projection of Plane – Different lamina like square rectangular, triangular, circle and Hexagonal pentagon. Trace of planes (HT and VT).

1.6 Identification of surfaces.

2. Sectioning

2.1 Importance and salient features

2.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections (theoretical only).

2.3 Orthographic sectional views of different objects.

UNIT III

1. Introduction of projection of right solids such as prism & pyramid (square, Pentagon, Hexagonal) cube, cone & cylinder (Axes perpendicular to H.P and parallel to V.P.)
2. Introduction of sections of right solids - Section planes, Sections of Hexagonal prism, pentagon pyramid, cylinder and cone (Section plane parallel to anyone reference planes and perpendicular to V.P. and inclined to H.P.)
3. Development of Surfaces – Development of lateral surfaces of right solids like cone, cylinder, pentagonal prism, pyramid and hexagonal pyramid (Simple problems)

UNIT IV

Isometric Views

1. Fundamentals of isometric projections and isometric scale.
2. Isometric views of different laminas like circle, pentagon and hexagon.
3. Isometric views of different regular solids like cylinder, cone, cube, cuboid, pyramid and prism.
4. Isometric views from given different orthographic projections(front, side and top view)

UNIT V

Introduction to AutoCAD

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets of different objects on AutoCAD (given pictorial/isometric view of a block). AutoCAD skill of student is evaluated in internal assessment only not in external exam.

RECOMMENDED BOOKS

1. Surjit Singh, “A Text Book of Engineering Drawing”, Dhanpat Rai & Co., Delhi.
2. PS Gill, “Engineering Drawing”, SK Kataria & Sons, New Delhi.
3. ND Bhatt, “Elementary Engineering Drawing in First Angle Projection”, Charotar Publishing House Pvt. Ltd., Anands.
4. T. Jeyapoovan, “Engineering Drawing and Graphics using AutoCAD”, Vikas Publishing House Pvt, Ltd Noida.
5. S.R.Singhal and O.P.Saxena, “A Text Book of Engineering Drawing”, Asian Publisher, Delhi.
6. RB Gupta, “Engineering Drawing”, Satya Prakashan, New Delhi.

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. First angle projection is to be

followed. Minimum of 20 sheets to be prepared and at least 2 sheets on AutoCAD**.** Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students. This subject contains five units of equal weight age.

1.5 FUNDAMENTALS OF IT

L	P
2	4

RATIONALE

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concepts of information technology and its scope, operating a computer: use of various office management tools, using internet and mobile applications etc. This course is intended to make new students comfortable with computing environment - Learning basic computer skills, learning basic application software tools, Understanding Computer Hardware, Cyber security awareness.

COURSE OUTCOMES

At the end of the subject student will be able to

CO1: Explain the basic components of Computers, Internet and issues of abuses/ attacks on information and computers
CO2: Handle the computer/laptop/mobiles/Internet Utilities and Install/Configure OS
CO3: Assemble a PC and connect it to external devices
CO4: Manage and Use Office practiced Automation Tools
CO5: Develop worksheets and Prepare presentations

DETAILED CONTENTS

UNIT I

Basics of Computer

Brief history of development of computers, Definition of Computer, Block diagram of a Computer, Hardware, Software, Booting: Cold and Hot Booting, Interaction between the CPU and Memory with Input/Output devices, Function of CPU and major functional parts of CPU. Memory, Bit, Nibble, Byte, KB, MB, GB, TB, PB, Functions of memory, Use of storage devices in a Computer, List types of memory used in a Computer, Importance of cache memory, CPU speed and CPU word length

UNIT II

Basic Internet Skills

Understanding browser, Introduction to WWW, efficient use of search engines, awareness about Digital India portals (state and national portals) and college portals. Advantages of Email, Various email service providers, Creation of email id, sending and receiving emails, attaching documents with email and drive.

Effective use of Gmail, G-Drive, Google Calendar, Google Sites, Google Sheets, Online mode of communication using Google Meet & WebEx.

UNIT III

Basic Logic building

Introduction to Programming, Steps involved in problem solving, Definition of Algorithm, Definition of Flowchart, Steps involved in algorithm development, differentiate algorithm and flowchart, symbols used in flowcharts, algorithms for simple problems, flowcharts for simple problems, Practice logic building using flowchart/algorithms

UNIT IV

Office Tools

Office Tools like LibreOffice/OpenOffice/MSOffice.

OpenOffice Writer – Typesetting Text and Basic Formatting, Inserting Images, Hyperlinks, Bookmarks, Tables and Table Properties in Writer

Introducing LibreOffice/OpenOffice *Calc*, Working with Cells, Sheets, data, tables, using formulae and functions, using charts and graphics.

OpenOffice Impress – Creating and Viewing Presentations, Inserting Pictures and Tables, Slide Master and Slide Design, Custom Animation.

UNIT V

Use of Social Media

Introduction to Digital Marketing – Why Digital Marketing, Characteristics of Digital Marketing, Tools for Digital Marketing, , Effective use of Social Media like LinkedIn, Google+, Facebook, Twitter, etc.: Features of Social media, Advantages and Disadvantages of Social Media.

PRACTICAL EXERCISES

1. Browser features, browsing, using various search engines, writing search queries
2. Visit various e-governance/Digital India portals, understand their features, services offered
3. Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, recognize various ports/interfaces and related cables, etc.
4. Using Administrative Tools/Control Panel Settings of Operating Systems

5. Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.
6. Explore features of Open Office tools and MS-Office, create documents, create presentation, create spread sheet, using these features, do it multiple times
7. Working with Conversion Software like pdfToWord, WordToPPT, etc.
8. Working with Mobile Applications – Searching for Authentic Mobile app, Installation and Settings, Govt. of India Mobile Applications
9. Creating email id, sending and receiving mails with attachments.
10. Using Google drive, Google calendar
11. Create Flow chart and Algorithm for the following

i. Addition of n numbers and display result
ii. To convert temperature from Celsius to Fahrenheit
iii. To find Area and Perimeter of Square
iv. Swap Two Numbers
v. find the smallest of two numbers
vi. Find whether given number is Even or Odd
vii. To print first n even Numbers
viii. find sum of series 1+2+3+…..+N
ix. print multiplication Table of a number
x. generate first n Fibonacci terms 0,1,1,2,3,5…n (n>2)
xi. sum and average of given series of numbers
xii. Factorial of number n (n!=1x2x3x…n)
xiii. Armstrong Number
xiv. Find whether given number is Prime or not

RECOMMENDED BOOKS

1. R.S. Salaria, “Computer Fundamentals”, Khanna Publishing House.
2. Ramesh Bangia, “PC Software Made Easy – The PC Course Kit”, Khanna Publishing House.
3. Online Resources, Linux man pages, Wikipedia
4. Mokhtar Ebrahim and Andrew Mallett, “Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell programming”.
5. Vikas Gupta, “Comdex Hardware and Networking Course Kit”, Dream Tech press, New Delhi, 2008.
6. Sumitabha Das, “UNIX concepts and applications” Tata McGraw Hill, New Delhi, 2008, Fourth Edition.

SUGGESTED WEBSITES

1. https://nptel.ac.in/courses/106/106/106106222/ - NPTEL Course on Modern Application Development
2. https://onlinecourses.swayam2.ac.in/aic19_de01/preview -
3. https://spoken-tutorial.org/ - Tutorials on Introduction to Computers, HTML, LibreOffice Tools, etc.
4. NOTEPAD++
5. https://tms-outsource.com/blog/posts/web-development-ide/

INSTRUCTIONAL STRATEGY

This is a skill based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

1.6 BASICS OF AUTOMOBILE ENGINEERING

L	P
2	-

RATIONALE

These days, automobile has become a necessity instead of luxury. The diploma holders in this course are required to supervise production and repair and maintenance of vehicles. For this purpose, knowledge and skills are required to be imparted to them regarding automobile industry as a whole. This subject aims at developing basic knowledge and skills in this area.

COURSE OUTCOMES

At the end of the subject student will be able to
CO1: Classify various types of vehicle layouts.
CO2: Identify various systems of an automobile.
CO3: Explain constructional details of vehicle body.
CO4: Describe the necessity of engine in an automobile.
CO5: Enlist various vehicle and road safety systems.

DETAILED CONTENTS

UNIT I

1. Introduction

Definition of automobile, Applications of automobiles, Classification of automobiles according to purpose, load capacity, fuel used, number of wheels, side of the drive, drive wheels, engine location & transmission; Leading manufacturers of scooter, motorcycles, car, bus and truck in India.

UNIT II

2. Automobile Chassis

Layout of two wheeler and four wheeler, Name and functions of their major assemblies, Types of drives – rear wheel drive, front wheel drive and four wheel drive. Their merits and demerits. Chassis frame types - Conventional, semi-integral and integral.

UNIT III

3. Automobile Body

Automobile body and its types. Requirements of body, Nomenclature of vehicle according to body. Types of car body, Constructional details of car body, Body streamlining, Interior fittings -

Rear view mirror, floor mats, upholstery, glove box, emergency flasher, air ventilators and Instrument panel.

UNIT IV

4. Power System

Introduction to power system, Various types of fuels, Internal and external combustion engines, Major components of engine and their functions – cylinder, piston, connecting rod, crank shaft, piston pin, crank shaft pin, cylinder head, valves. Engine terminology including bore, stroke, dead centres - TDC/BDC & ODC/IDC, engine capacity, Introduction to four stroke SI engine and four stroke CI engine.

UNIT V

5. Vehicle and Road Safety

Need of safety system, Active and passive safety, Various types of safety devices like helmet, seat belt, and air bags, Definition of road safety, Road signs and signals. Road markings, Traffic light, Traffic police signals, Traffic rules, Tips for safe driving.

RECOMMENDED BOOKS

1. R.B. Gupta, “Automobile Engineering”, Satya Parkashan, New Delhi, Tenth Edition, 2018.
2. A.K. Babu and Ajit Pal Singh, “Automobile Engineering”, S. Chand & Company, New Delhi, Second Edition, 2014.
3. Vijay Singh and Raj Kumar, “Chassis, Body and Transmission”, Ishan Publications, Jalandhar, First Edition, 2015.

INSTRUCTIONAL STRATEGY

In addition to blackboard teaching, the instructions should be given with the help of working models, charts, cut-section models, animated videos and demonstration of vehicles. A visit to nearby Traffic Park can help the students to better understand the traffic rules and regulations. This subject contains five units of equal weightage.

1.7 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

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RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industrial and construction activities so that he/she may help in balancing the ecosystem and controlling pollution by various control measures. The course is intended to provide a general concept in the dimensions of environmental pollution and disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.

COURSE OUTCOMES

After undergoing the subject, the student will be able to:

CO1: Comprehend the importance of sustainable ecosystem.
CO2: Clarify interdisciplinary nature of environmental issues.
CO3: Describe corrective measures for the abatement of pollution.
CO4: Identify the role of non-conventional energy resources in environmental protection.
CO5: Recognize various types of disasters.

DETAILED CONTENTS

UNIT I
Introduction

1.1 Basics of ecology, eco system- concept, and sustainable development, Sources, advantages, disadvantages of renewable and nonrenewable energy.
1.2 Rain water harvesting
1.3 Deforestation – its effects & control measures

UNIT II
Air and Noise Pollution

2.1 Air Pollution: Source of air pollution. Effect of air pollution on human health, economy, Air pollution control methods.
2.2 Noise Pollution: Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimizing noise pollution.

UNIT III

Water and Soil Pollution

3.1 Water Pollution: Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of DO, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

3.2 Soil Pollution :Sources of soil pollution, Effects and Control of soil pollution, Types of Solid waste- House hold, Industrial, Agricultural, Biomedical, Disposal of solid waste, Solid waste management E-waste, E – waste management

UNIT IV

Impact of Energy Usage on Environment

Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings, Concept of Carbon Credit & Carbon footprint.

UNIT V

Disaster Management

A. Different Types of Disaster:

Natural Disaster: such as Flood, Cyclone, Earthquakes and Landslides etc.

Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc.

B.Disaster Preparedness:

Disaster Preparedness Plan

Prediction, Early Warnings and Safety Measures of Disaster

Psychological response and Management (Trauma, Stress, Rumour and Panic)

RECOMMENDED BOOKS

1. S.C. Sharma & M.P. Poonia, “Environmental Studies”, Khanna Publishing House, New Delhi.
2. BR Sharma, “Environmental and Pollution Awareness”, Satya Prakashan, New Delhi.
3. Dr. RK Khitoliya, “Environmental Pollution”, S Chand Publishing, New Delhi.
4. Erach Bharucha, “Environmental Studies”, University Press (India) Private Ltd., Hyderabad.
5. Suresh K Dhamija, “Environmental Engineering and Management”, S K Kataria and Sons, New Delhi.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/BTE/NITTTR, Chandigarh.
7. Dr. Mrinalini Pandey, “Disaster Management”, Wiley India Pvt. Ltd.

8. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill Education (India) Pvt. Ltd.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies and Disaster Management like expert lectures, seminars, visits etc. may also be organized This subject contains five units of equal weightage.

1.8 GENERAL WORKSHOP PRACTICE

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RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General Workshop Practice is included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

COURSE OUTCOMES

After undergoing this subject, the students will be able to:

CO1: Identify tools, equipment and materials used in preparing jobs.
CO2: Take measurements with the help of basic measuring tools/equipment.
CO3: Select materials, tools, and sequence of operations to make a job as per given specifications/drawing.
CO4: Prepare simple jobs independently and inspect the same.
CO5: Use safety equipment and Personal Protection Equipment (PPE).
CO6: Maintain good housekeeping practices.

DETAILED CONTENTS CUM PRACTICAL EXERCISES

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1. Welding Shop I
2. Fitting and Plumbing Shop I
3. Sheet Metal Shop
4. Carpentry Shop I
5. Painting Shop
6. Electric and Electronics Shop I

1. WELDING SHOP – I

1.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

1.2 Introduction and importance of welding process as compared to other material joining processes. Specifications and type of ARC welding machines, parts identification, classification, selection and coding of electrodes, welding parameters, welding joints and welding positions. Common weldable materials, safety precautions in welding shop, use of Personal Protective Equipment, Use of welding screens, Hazards and remedies during welding, Elementary symbolic representations, demo of tools, equipment, sample jobs prepared, set up of Gas welding apparatus, and welding defects.

1.3 Jobs to be prepared

- Job I Practice of striking arc and depositing uniform and straight beads onflat at different current levels. (Minimum 4 beads on M.S. flat at four setting of current level using shielded metal arc welding and differentiating their characteristics).
- Job II Edge Preparation and welding lap joint using shielded metal arcwelding (SMAW) process.
- Job III Edge Preparation and welding butt joint using shielded metal arcwelding process.
- Job IV Edge Preparation and welding T Joint using shielded metal arcwelding (100mm x 6 mm M.S. Flat).
- Job V To make a simple job using oxy acetylene gas welding.

2. FITTING AND PLUMBING SHOP – I

2.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

2.2 Introduction and Function of holding/ clamping devices, hand tools and cutting tools,

2.3 Practical applications of fitting and plumbing

2.4 Introduction, function and types of marking and measuring tools and instruments (surface plate, try square, caliper, steel rule, scriber and Vernier caliper)

2.5 Identification of materials. (Iron, Copper, Stainless Steel, Aluminum etc.) and identification of various steel sections (flat, angle, channel, bar etc.).

2.6 Introduction to various types of pipes (eg water, steam, gas etc) and functions of various pipe fitting items (GI pipe fittings, CPVC pipe fittings), Methods of pipe joints

2.7 Introduction to various types of threads (internal and external)

2.8 Description and demonstration of various types of drills, taps and dies.

2.9 Jobs to be prepared:

- Job I To fit hacksaw blade in its frame and perform hacksawing operation byusing marking media and marking tool and straight sawing practice.
- Job II To perform filing on MS workpiece (75 * 50 * 6 mm) for giving it aperfect rectangular shape and drilling, tapping operation.

Job III To perform step filing operation at right angle on MS workpiece.

Job IV Making external threads on a pipe by using die and to make a PVC/GI pipe connection using nipple and socket.

Job V Fitting of all components of wash basin and ball valve in a tank.

3. SHEET METAL SHOP

3.1. Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, best practices in the concerned shop.

3.2 Demonstration of various power tools, apparatus, equipment, hand tools used in sheet metal shop.

3.3 Jobs to be prepared

Job I Prepare a seam joint by using hand tools on GI sheet.

Job II To prepare riveted lap joint (single/double) on GI sheet.

Job III To fabricate a funnel of GI sheet using operations of shearing, flatteningand bending.

Job IV To fabricate a conduit joint using various sheet metal operations.

Job V To fabricate a utility job (eg soap case/file tray/canister box) of thin GIsheet.

4. CARPENTRY SHOP - I

4.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

4.2 Introduction and industrial applications of carpentry jobs.

4.2.1 Name and use of raw materials used in carpentry shop : wood & alternative materials(board, plywood)

4.2.2 Introduction to wood, timber and their identification, shapes and specifications, their properties, applications & defects. Study of the joints in roofs, doors, windows and furniture, seasoning of wood

4.2.3 Names, uses, and types of hand tools such as Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools, measuring tools etc.

4.2.4 Specification of iron jack plane used in carpentry shop.

4.3 Practice

4.3.1 Practices for Basic Carpentry Work

4.3.2 Sawing practice using different types of saws

4.3.3 Assembling jack plane — planning practice including sharpening and bladeadjustment of jack plane cutter

4.3.4 Chiselling practice using different types of chisels including sharpening ofchisel

4.3.5 Making of different types of wooden pin and fixing methods. Markingmeasuring and inspection of jobs.

4.3.6 Housekeeping practices and instructions.

4.4 Jobs to be Prepared

Job 1 Prepare a rectangular wooden block involving operations likeMarking, sawing, planning to size, chiseling.

Job II Prepare a Half Lap Joint (cross, L or T – any one).

Job III Prepare a Mortise and Tenon joint (T-Joint).

Job IV Prepare a Dove tail Joint (Half lap dovetail joint.

Job V Prepare a Bridle Joint.

5. PAINTING SHOP

5.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

5.2 Introduction to paints, varnishes, primers and their types, General properties of paints, Constituents of paints, polishes, their advantages and applications.

5.3 Introduction of powder coating and spray painting with their uses. Different types of tools and equipment used in polishing and painting.

5.4 Preparation of different colours of the paints by using prime colours, Practical demonstration of powder coating and spray painting on a utility object

5.5 Jobs to be Prepared

Job I Prepare wooden surface for painting such as cleaning, sanding, applying putty, filling procedure and application of primer coat andbrush paint the same.

Job II Painting on wooden and metallic surfaces by spray gun.

Job III Practice of lettering: name plates / sign board.

Job IV Practice of dip painting/powder coating.

Job V Prepare wooden surface for polishing, apply French polish on woodensurface.

6. ELECTRICAL AND ELECTRONICS SHOP - I

6.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, best practices in the concerned shop.

6.2 Demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, MCB & ELCB, fuses, cleats, clamps and allied items, tools and accessories.

6.3 Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs. Difference between series and parallel wiring.

6.4 Jobs to be performed

Job I Carrying out house wiring circuits using fuse, switches, sockets,ceiling rose etc. in batten or P.V.C. casing-caping. Demo of conduit wiring through junctions.

Job II To prepare a three level Godown wiring circuit with PVC conduitwiring system.

Job III Installation of Solar Panel, inverter and batteries.

6.5 Identification and familiarization with the following tools used in electronic shop such as Tweezers, Screw drivers (different sizes), Insulated Pliers, Cutter, Sniper, Philips Screw Driver (Star Screw Driver), L- Keys, Soldering Iron, soldering wire, flux and their demonstration and uses. Identification and familiarization with multimeter (analog and digital). Various types of protective devices such as wire fuse, cartridge fuse etc. Identification and familiarization with ear phone speaker connector, telephone jacks and similar male and female connectors (audio, video).

6.6 Jobs to be performed

Job IV Practice in the use of tools and instruments used in electronicshop. For this a small experimental set up may be done.

Job V Cut, strip, join an insulated wire with the help of soldering iron (repeat with different types of wires).

RECOMMENDED BOOKS

1. SK Hajra Choudhary and AK Choudhary, "Workshop Technology I, II, III", Media Promoters and Publishers Pvt. Ltd., Mumbai, Fifteenth Edition, 2016.
2. RK Jain, "Workshop Technology Vol I& II'', Khanna Publishers, New Delhi, First Edition,2021.
3. Manchanda, "Workshop Technology Vol. I, II, III", India Publishing House, Jalandhar.
4. S.S. Ubhi, "Workshop Training Manual Vol. I, II'', Katson Publishers, Ludhiana.
5. K Venkata Reddy, "Manual on Workshop Practice", MacMillan India Ltd., New Delhi,Sixth Edition, 2020.
6. "General Workshop Manual (Diploma Jobs)", Khanna Publishers, First Edition, 2021.
7. T Jeyapoovan, "Basic Workshop Practice Manual", Vikas Publishing House (P) Ltd., NewDelhi.
8. B. S. Raghuvanshi, "Workshop Technology, Vol. I", Dhanpat Rai and Sons, Delhi, EleventhEdition, 2017.
9. Kannaiah K L, Narayana, "Workshop Manual", Scitech Publications, Chennai, Second Edition 1998.
10. H S Bawa, "Workshop Practice", Tata McGraw Hill Publication, First Edition, 2004

INSTRUCTIONAL STRATEGY

This is hands-on practice based workshop for development of required skills in the students.

SECOND SEMESTER

SECOND SEMESTER

2.1	Applied Mathematics II	54-56
2.2	Applied Physics-II	57-60
2.3	Applied Chemistry	61-64
2.4	Applied Mechanics	65-68
2.5	Mechanical Engineering Drawing- I	69-71
2.6	Workshop Technology -I	72-75
2.7	Workshop Practice- I	76-80

2.1 APPLIED MATHEMATICS - II

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RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of Differential calculus, Integral calculus and Differential Equations have been included in this course. This will develop analytical abilities to apply in engineering field and will provide continuing educational base to the students.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Formulate the engineering problems into mathematical format with the use of differential equations and differential

C02: Use the differentiation and Integration in solving various Mathematical and Engineering problems.

CO3: Calculate the approximate area under a curve by applying integration and numerical methods.

CO4: Discuss the purposes of measures of central tendency and calculate the measures of central tendency (mode, median, mean) for a set of data.

CO5: Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

DETAILED CONTENTS

UNIT I

Differential Calculus

1.1 Definition of function; Concept of limits (Introduction only) and problems related to four standard limits only.

1.2 Differentiation of x^n, sin x, cos x, e^x by first principle.

1.3 Differentiation of sum, product and quotient of functions.

UNIT II

Differential Calculus and Its Applications

2.1 Differentiation of trigonometric functions, inverse trigonometric functions. Logarithmic differentiation, successive differentiation (upto 2nd order)

2.2 Application of differential calculus in:

(a) Rate measures (b) Maxima and minima

UNIT III

Integral Calculus

3.1 Integration as inverse operation of differentiation with simple examples.

3.2 Simple standard integrals and related problems, Integration by Substitution method and Integration by parts.

3.3 Evaluation of definite integrals with given limits.

Evaluation of $\int_0^{\pi/2} \sin^n x.\, dx$, $\int_0^{\pi/2} \cos^n x\, dx$, $\int_0^{\pi/2} \sin^m x\ \cos^n x\, dx$

using formulae without proof (m and n being positive integers only) using pre-existing mathematical models.

UNIT IV

Application of Integration, Numerical Integration and Differential Equations

4.1 Applications of integration: for evaluation of area under a curve and axes (Simple problems).

4.2 Numerical integration by Trapezoidal Rule and Simpson's $1/3^{rd}$ Rule using pre-existing mathematical models.

Differential Equations

4.3 Definition, order, degree, Type of differential Equations, linearity, Formulation of ordinary differential equation (up to 1^{st} order), solution of ODE (1^{st} order) by variable separation method.

UNIT V

Statistics and Software

Statistics

5.1 Measures of Central Tendency: Mean, Median, Mode

5.2 Measures of Dispersion: Mean deviation, Standard deviation

Software

5.3 SciLab software – Theoretical Introduction.

5.4 Basic difference between MATLAB and SciLab software,

5.5 Calculations with MATLAB or ScilLab - (a) Representation of matrix (2×2 order), (b) Addition, Subtraction of matrices (2×2 order) in MATLAB or SciLab

RECOMMENDED BOOKS

1 R. D. Sharma, "Applied Mathematics – I & II for Diploma Courses", Dhanpat Rai Publications.

2 "Mathematics for Class XI", NCERT Publication, New Delhi.

3 "Mathematics for Class XII", NCERT Publication, New Delhi.

4 H. K Dass, "Applied Mathematics for Polytechnics", CBS Publishers & Distributers.
5 A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics –I", CBS Publisher, New Delhi.
6 A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics –II", CBS Publisher, New Delhi.
7 G. B. Thomas, R. L. Finney, "Calculus and Analytic Geometry", Addison Wesley, Ninth Edition.
8 B S Grewal, "Elementary Engineering Mathematics", Khanna Publishers, Delhi, Thirty-fifth Edition.
9 R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics" Narosa Publishing House, New Delhi, Second Edition, 2003.
10 SS Sabharwal & Dr Sunita Jain, "Applied Mathematics Vol. I & II", Eagle Parkashan, Jalandhar.
11 S Kohli, "Engineering Mathematics Vol. I & II", IPH, Jalandhar.
12 Reena Garg & Chandrika Prasad, "Advanced Engineering Mathematics", Khanna Publishing House, New Delhi.
13 R. Pratap, "Getting Started with MATLAB 7", Oxford University Press, Seventh Edition.
14 E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1) https://www.scilab.org
2) http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is theoretical subject and contains five units of 20% equal weight age.
Basic elements of Differential Calculus, Integral Calculus, and Differential Equations can be taught in the light of their applications in the field of engineering and technology. By laying more stress on applied part, teachers can also help in providing continuing education base to the students. Students need to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics that the industry requires. For example they need to know how to use mathematical models that use integration as opposed to learning how integration can be used. Useful authenticated software MATLAB or open source software SciLab can be taught theoretically by books/online literatures and basic operations can be shown practically with practical software laboratory or small mobile apps of these software or authentic Trial version of MATLAB/ SciLab software. Diploma students need to know which tools to use and how to do the job.

2.2 APPLIED PHYSICS - II

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RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various technical fields are given prominence in the course content to prepare students for various technical applications.

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1: Differentiate between types of waves and their motion.

CO2: Illustrate laws of reflection and refraction of light.

CO3: Demonstrate competency in phenomena of electrostatics and electricity.

CO4: Characterize properties of material to prepare new materials for various technical applications.

CO5: Demonstrate a strong foundation on Modern Physics to use at various technical applications.

DETAILED CONTENTS

UNIT I

Wave Motion and its Applications

1.1 Waves: definition, types (mechanical and electromagnetic wave)

1.2 Wave motion- transverse and longitudinal with examples, terms used in wave motion like displacement, amplitude, time period, frequency, wavelength, wave velocity; relationship among wave velocity, frequency and wave length

1.3 Simple harmonic motion (SHM): definition, examples

1.4 Cantilever: definition, formula of time period (without derivation)

1.5 Free, forced and resonant vibrations with examples
1.6 Sound waves: types (infrasonic, audible, ultrasonic) on the basis of frequency, noise, coefficient of absorption of sound, echo

UNIT II

Optics

2.1 Reflection and refraction of light with laws, refractive index
2.2 Lens: introduction, lens formulae (no derivation), power of lens and simple numerical problems
2.3 Total internal reflection and its applications, critical angle and conditions for total internal reflection
2.4 Superposition of waves (concept only), definition of Interference, Diffraction and Polarization of waves
2.5 Introduction to Microscope, Telescope and their applications

UNIT III

Electrostatics and Electricity

3.1 Electric charge, unit of charge, conservation of charge
3.2 Coulomb's law of electrostatics
3.3 Electric field, electric lines of force (definition and properties), electric field intensitydue to a point charge
3.4 Definition of electric flux, Gauss law (statement and formula)
3.5 Capacitor and capacitance (with formula and unit)
3.6 Electric current and its SI Unit, direct and alternating current
3.7 Resistance, conductance (definition and unit)
3.8 Series and parallel combination of resistances
3.9 Ohm's law (statement and formula)

UNIT IV

Classification of Materials and their Properties

4.1 Definition of energy level, energy bands
4.2 Types of materials (conductor, semiconductor, insulator and dielectric) with examples,intrinsic and extrinsic semiconductors (introduction only)
4.3 Introduction to magnetism, type of magnetic materials: diamagnetic, paramagneticand

ferromagnetic materials with examples

4.4 Magnetic field, magnetic lines of force, magnetic flux

4.5 Electromagnetic induction (definition)

UNIT V

Modern Physics

5.1 Laser: introduction, principle, absorption, spontaneous emission, stimulated emission, population inversion

5.2 Engineering and medical applications of laser

5.3 Fibre optics**:** introduction to optical fibers (definition, principle and parts), light propagation, fiber types (mono-mode, multi-mode), applications in medical, telecommunication and sensors

5.4 Nanotechnology: introduction, definition of nanomaterials with examples, properties at nanoscale, applications of nanotechnology (brief)

PRACTICAL EXERCISE

1. Familiarization with apparatus (resistor, rheostat, key, ammeter, voltmeter, telescope, microscope etc.)
2. To find the time period of a simple pendulum.
3. To study variation of time period of a simple pendulum with change in length of pendulum.
4. To determine and verify the time period of Cantilever.
5. To verify Ohm's laws by plotting a graph between voltage and current.
6. To study colour coding scheme of resistance.
7. To verify laws of resistances in series combination.
8. To verify laws of resistance in parallel combination.
9. To find resistance of galvanometer by half deflection method.
10. To verify laws of reflection of light using mirror.
11. To verify laws of refraction using glass slab.
12. To find the focal length of a concave lens, using a convex lens.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XII (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. Dr. HH Lal, "Applied Physics, Vol. I & II", TTTI Publications, Tata McGraw Hill,Delhi.

3. AS Vasudeva, "Applied Physics –II", Modern Publishers, Jalandhar.
4. R A Banwait, "Applied Physics – II", Eagle Prakashan, Jalandhar.
5. N Subrahmanyam, Brij Lal and Avadhanulu, "A text book of OPTICS", S ChandPublishing, New Delhi.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/NITTTR.
7. M H Fulekar, "Nanotechnology: Importance and Applications", IK InternationalPublishing House (P) Ltd., New Delhi.
8. C. L. Arora, "Practical Physics", S Chand Publication.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

2.3 APPLIED CHEMISTRY

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RATIONALE

The regular use of a variety of chemistry based materials and processes in diverse technical and engineering fields have repeatedly proven the importance of Applied Chemistry and its role in current and future technological advancements. Ever increasing use of chemical materials in the emerging engineering applications demands engineers and technocrats to acquire an in-depth knowledge of Applied Chemistry to be able to choose the best suited materials to meet their needs while maintaining the environment sustainability. An understanding of the principles of Applied Chemistry will develop scientific attitude in the budding engineers to understand the physical and chemical properties of the available materials for engineering applications as well as an ability to design new and effective materials.

COURSE OUTCOMES

After studying this subject, students will be able to:

CO1: Classify the elements into metals, non-metals and metalloids.

CO2: Explain the extraction of metals from ores, their mechanical properties and modification of properties by alloy formation.

CO3: Classify fuels and lubricants and apply them in different engineering applications.

CO4: Identify the polymeric materials, assess their properties and design suitable polymericmaterials for current and future applications.

CO5: Apply effective methods for corrosion prevention,

DETAILED CONTENTS

UNIT 1

Atomic Structure, Periodic Table and Chemical Bonding.

1.1 Bohr's model of atom (qualitative treatment only), dual character of matter: derivation of de-Broglie's equation, Heisenberg's Principle of Uncertainty, modern concept of atomic structure: definition of orbitals, shapes of s, p and d-orbitals, quantum numbers and their significance. Electronic configuration: Aufbau and Pauli's exclusion principles and Hund's rule, electronic

configuration of elements up to atomic number 30.

1.2 Modern Periodic law and Periodic table, classification of elements into s, p, d and f-blocks, metals, non-metals and metalloids (periodicity in properties excluded).

1.3 Chemical bonding: cause of bonding, ionic bond, covalent bond, and metallic bond (electron sea or gas model), Physical properties of ionic, covalent and metallic substances.

UNIT II

Metals and Alloys

2.1 Metals: mechanical properties of metals such as conductivity, elasticity, strength and stiffness, luster, hardness, toughness, ductility, malleability, brittleness, and impact resistance and their uses.

2.2 Definition of a mineral, ore, gangue, flux and slag. Metallurgy of iron from haematite using a blast furnace. Commercial varieties of iron.

2.3 Alloys: definition, necessity of making alloys, composition, properties and uses of duralumin and steel. Heat treatment of steel- normalizing, annealing, quenching, tempering.

UNIT III

Water, Solutions, Acids and Bases

3.1 Solutions: definition, expression of the concentration of a solution in percentage (w/w, w/v and v/v), normality, molarity and molality and ppm. Simple problems on solution preparation.

3.2 Arrhenius concept of acids and bases, strong and weak acids and bases, pH value of a solution and its significance, pH scale. Simple numerical problems on pH of acids and bases.

3.3 Hard and soft water, causes of hardness of water, types of hardness – temporary and permanent hardness, expression of hardness of water, ppm unit of hardness; disadvantages of hard water; removal of hardness: removal of temporary hardness by boiling and Clark's method; removal of permanent hardness of water by Ion-Exchange method; boiler problems caused by hard water: scale and sludge formation, priming and foaming, caustic embrittlement; water sterilization by chlorine, UV radiation and RO.

UNIT IV

Fuels and Lubricants

4.1 Fuels: definition and classification of higher and lower calorific values, units of calorific value, characteristics of an ideal fuel. Petroleum: composition and refining of petroleum; gaseous fuels: composition, properties and uses of CNG, PNG, LNG, LPG; relative advantages of liquid and gaseous fuels over solid fuels. Scope of hydrogen as future fuel.

4.2 Lubricants- Functions and qualities of a good lubricant, classification of lubricants with

examples; lubrication mechanism (brief idea only); physical properties (brief idea only) of a lubricant: oiliness, viscosity, viscosity index, flash and fire point, ignition temperature, pour point.

UNIT V

Polymers and Electrochemistry

5.1 Polymers and Plastics: definition of polymer, classification, addition and condensation polymerization; preparation properties and uses of polythene, PVC, Nylon-66, Bakelite; definition of plastic, thermoplastics and thermosetting polymers; natural rubber and neoprene, other synthetic rubbers (names only).

5.2 Corrosion: definition, dry and wet corrosion, factors affecting rate of corrosion, methods of prevention of corrosion—hot dipping, metal cladding, cementation, quenching, cathodic protection methods

5.3 Introduction and application of nanotechnology: nano-materials and their classification, applications of nanotechnology in various engineering applications (brief).

PRACTICAL EXERCISES

1. To prepare standard solution of oxalic acid.
2. To dilute the given $KMnO_4$ solution
3. To find out the strength in grams per litre of an unknown solution of sodium hydroxide using a standard (N/10) oxalic acid solution.
4. To find out the total alkalinity in parts per million (ppm) of a water sample with the help of a standard sulphuric acid solution.
5. To determine the total hardness of given water sample by EDTA method
6. To determine the amount of total dissolved solids(TDS) in ppm in a given sample of water gravimetrically
7. To determine the pH of different solutions using a digital pH meter.
8. To determine the calorific value of a solid/liquid fuel using a Bomb calorimeter.
9. To determine the viscosity of a lubricating oil using a Redwood viscometer
10. To prepare a sample of Phenol-formaldehyde resin (Bakelite)/Nylon-66 in the lab.

RECOMMENDED BOOKS

1. "Textbook of Chemistry for class XI and XII (part I & II) NCERT", Delhi, 2017-18.
2. C.N. R. Rao, "Understanding Chemistry", Universities Press (India) Pvt. Ltd, 2011.

3. Jain & Jain, "Engineering Chemistry", Dhanpat Rai and Sons; New Delhi, 2015.
4. Dr. G. H. Hugar & Prof A. N. Pathak, "Applied Chemistry Laboratory Practices, Vol. I and Vol. II", NITTTR, Chandigarh, Publications, 2013-14.
5. Rajesh Agnihotri, "Chemistry for Engineers", Wiley India Pvt. Ltd, 2014.
6. "Applied Chemistry" by Usha Raju.

SUGGESTED WEBSITES

1. www.chemguide.co.uk/atommenu.html (Atomic structure and chemical bonding)
2. www.visionlearning.com (Atomic structure and chemical bonding)
3. www.cheml.com (Atomic structure and chemical bonding)
4. https://www.wastewaterelearning.com/elearning/ (Water treatment)
5. www.capital-refractories.com (Metals, Alloys, Cement, and Refractory Materials)
6. www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf (Fuel and Combustion)

INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career. This subject contains five units of equal weightage.

2.4 APPLIED MECHANICS

L	P
3	2

RATIONALE

This course Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

COURSE OUTCOMES

After undergoing this subject, the students will be able to:
CO1: Draw free body diagrams.by analyzing different types of forces acting on a body.
CO2: Determine the resultant of coplanar concurrent forces.
CO3: Solve problems by using principle of moment.
CO4: Calculate the least force required to maintain equilibrium on an inclined plane.
CO5: Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
CO6: Determine velocity ratio, mechanical advantage and efficiency of simple machines.

DETAILED CONTENTS

UNIT 1

1. Introduction

Concept of mechanics, Classification of mechanics, utility of mechanics in engineering field, Concept of rigid body, scalar and vector quantities.

2. Laws of forces

Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force, Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of superposition, Free body diagram, Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, parallelogram law of forces (with derivation), triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving

a force into two rectangular components, Lami's theorem, Simple numericals, Equilibrium of forces and its determination.

UNIT II

3. Moment

Concept of moment, Moment of a force and units of moment, Varignon's theorem (definition only), Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve), Simple numericals. Parallel forces (like and unlike parallel force), calculating their resultant, Concept of couple, its properties and effects, General conditions of equilibrium of bodies under coplanar forces, Position of resultant force by moment.

UNIT III

4. Friction

Definition and concept of friction, types of friction, force of friction, Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction, Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane. Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force acting along the inclined plane and subjected to a force acting at some angle with the inclined plane, Simple numericals.

UNIT IV

5. Centre of Gravity and Centroid

Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies. Axis of symmetry, Reference axis. Determination of centroid of plain and composite lamina (T, L, C and I shape) using moment method only, centroid of bodies with removed portion. Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed.

6. Laws of Motion

Newton’s laws of motion and their applications, Concept of momentum. Derivation of force equation from second law of motion, numerical problems on second law of motion. Bodies tied with string, Newton’s third law of motion, numerical problems, conservation of momentum, impulse and impulsive force.

UNIT V

7. Simple Machines

Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines, Simple and compound machine (Examples). Definition of ideal machine, reversible and self locking machine. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency, Simple numericals. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency. Working principle and application of wheel and axle, Weston's Differential Pulley Block, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application.

PRACTICAL EXERCISES

1. Verification of polygon law of forces using universal force table/Gravesend apparatus.
2. Verification of Lami's theorem.
3 To verify law of moments by using Bell crank lever.
4. To verify the forces in different members of jib crane.
5. To determine coefficient of friction between three pairs of given surface.
6. To find out center of gravity of regular lamina.
7. To find out center of gravity of irregular lamina.
8. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
9. To find the mechanical advantage, velocity ratio and efficiency of worm andworm wheel.
10. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.

RECOMMENDED BOOKS

1. Birinder Singh,"Text Book of Applied Mechanics", Katson Publishing House, New Delhi.
2. A. K. Upadhyay, "Text Book of Applied Mechanics", SK Kataria & Sons, New Delhi.
3. S. Ramamurtham, "A Text Book of Applied Mechanics", Dhanpat Rai Publishing Company Pvt. Ltd, Delhi.
4. R. S. Khurmi, "A Text Book of Engineering Mechanics (Applied Mechanics)", S Chand andCo. Ltd., New Delhi.
5. R. K. Rajput, "A Text Book of Applied Mechanics", Laxmi Publications, New Delhi.
6. D. S. Bedi, "Engineering Mechanics", Khanna Publishing House, New Delhi.

INSTRUCTIONAL STRATEGY

This is hands-on practice based subject and topics taught in the class should be practiced in the lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

2.5 MECHANICAL ENGINEERING DRAWING-I

L	P
-	6

RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

Note:

1) First angle projection is to be followed.
2) Minimum 15 sheets to be prepared.
3) BIS Code SP 46-1988 should be followed.
4) Instructions relevant to various drawings may be given along with appropriate demonstration before assigning drawing practice to the students.
5) 20 percent of drawing sheets to be prepared on the third angle projection.
6) Use CAD software.

COURSE OUTCOMES

After undergoing the course, the students will be able to:

CO1: Draw the assembly from part details of objects.
CO2: Identify and draw different types of screw threads.
CO3: Draw different types of nuts, bolts and washers.
CO4: Draw various locking devices.
CO5: Draw different section of various types of keys and cotter joints.
CO6: Draw various riveted joints.
CO7: Draw various types of couplings used in power transmission.
CO8: Prepare drawing using AutoCAD.

PRACTICAL EXERCISES

1. Detail and Assembly Drawing (02 sheets)

Principle and utility of detail and assembly drawings, Practical exercise on drawing from detail to assembly or vice versa using different wooden joints as example (lap joint – T joint and corner joint, Mortise and tenon joint, Bridle joint, Mitre faced corner joint).

2. Threads (02 sheets)

Nomenclature of threads, types of threads. Single and multiple start threads, right hand and left hand thread. Forms of various external thread sections such as V thread (Metric thread, British associate, American thread, Basic whitworth thread), Square, Acme, Knuckle, and Buttress thread. Simplified conventional representation of V thread.

3. Nuts and Bolts (03 sheets)

Different views of hexagonal and square headed nuts and bolts. Assembled view of nuts and bolts with washers. Foundation bolt- Rag bolt, Hook bolt. Lewis bolt, Eye bolt and curved bolt (Free hand)

4. Locking Devices (01 sheet)

Locking nuts - Castle nut, Sawn nut, and Split pin lock nut. Locking by spring washers,Locking plates.

5. Screws, Studs and Washers (01 sheet)

Drawing of various types of machine and set screws. Drawing of various types' of studs, through bolt, tap bolt and stud bolt.

6. Keys and Cotters (03 sheets)

Various types of keys and their application. Preparation of drawings of various keys and cotters. Various types of joints (a) Gib and Cotter joint (b) Knuckle joint (c) Spigot andSocket joint

7. Rivets and Riveted Joints (02 sheets)

Types of general purpose rivet heads (Snap Head, Pan Head , Flat and counter sunk). Types of riveted joints – lap (single and double riveted), butt (single cover plate and double cover plate), chain and zig-zag riveting (Double riveted). Caulking and fullering operation of riveted joints.

8. Shaft Coupling (02 sheets)

Introduction to coupling, their uses and types, Muff Coupling, Protected type flange coupling. Flexible or non-rigid coupling

9. Computer Aided Drafting (CAD) (04 sheets)

Introduction, Various 2 D commands – Draw, modify and option commands, Prepare at least 4 sheets using CAD software – one drawing each from wooden joint, threads, nut and bolts, coupling.

Note : CAD drawing will be evaluated internally for sessional marks and not by final theory paper.

RECOMMENDED BOOKS

1. Surjit Singh, "A Text Book of Engineering Drawing", Dhanpat Rai Publishing Company,New Delhi.
2. P.S. Gill, "Engineering Drawing", SK Kataria and Sons, New Delhi.
3. N.D. Bhatt, "Mechanical Engineering Drawing", Charotar Publishing House, Anand
4. T Jeyapoovan, "Engineering Drawing and Graphics Using AutoCAD", Vikas Publishing House Pvt. Limited, Delhi.
5. Sham Tickoo and D. Sarvanan, "AutoCAD : For Engineers & Designers", Wiley India Pvt.Ltd., Delhi

INSTRUCTIONAL STRATEGY

The teachers should first demonstrate then assist the students to prepare drawing sheets. The student should also be encouraged and motivated to learn CAD software at the earliest and do the given exercises.

2.6 WORKSHOP TECHNOLOGY- I

L	P
3	-

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about hand tools, measuring instruments, welding, and various machining processes is required to be imparted. Hence the subject of workshop technology.

COURSE OUTCOMES

After undergoing the subject, students will be able to:
CO1: Classify various types of hand tools.
CO2: Explain working principle of vernier caliper and micrometer for measurement.
CO3: Explain the parts of lathe and their functions.
CO4: Select material and tool geometry for cutting tools on lathe.
CO5: Explain geometry of single point tool, various types of lathe tools and tool materials.
CO6: Explain the working of drilling and boring process.
CO7: Explain the nomenclature of a drill and boring tools.
CO8: Select most appropriate process, electrodes, various process parameters for a job.
CO9: Explain principle of gas welding and arc welding process.
CO10: Select a cutting fluid for an operation.

DETAILED CONTENTS

UNIT I

1. Hand Tools

Chisels – Types and uses of chisels, wood working chisels, metal working chisels – cold chisel, hard chisel, stone chisel, masonry chisel. Hammers – Types, Basic design and variations, Physics of hammering, Hammer as force multiplier, effect of head's mass, effect of handle.
Saw – Saw terminology, types of saws, types of saw blades, material used for saw, Hacksaw frame and its types. Pliers – Function and types. Wrenches/ Spanners – Common General wrenches/spanners, Specialized wrenches/spanners, Surface plate, V block, files, Surface Gauge.

2. Measuring Instruments

Calipers – Types – Inside, outside, divider, Odd leg caliper. Vernier Caliper- Parts, uses, checking error, least count, working principle. Outside micrometer - Introduction, parts, Principle, Least count, Checking zero error.

UNIT II

3. Cutting Tools and Cutting Materials

Cutting Tools - Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect.

Cutting Tool Materials - Properties of cutting tool material, Study of various cutting tool materials viz. High-speed steel, tungsten carbide, cobalt steel cemented carbides, stellite, ceramics and diamond.

UNIT III

4. Welding

Welding Process - Principle of welding, Classification of welding processes, Advantages and limitations of welding, Industrial applications of welding, Welding positions and techniques, symbols. Safety precautions in welding.

Gas Welding - Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - Gas welding torch, Oxygen cylinder, acetylene cylinder, cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes and personal safety equipment for welding.

Arc Welding - Principle of operation, Arc welding machines and equipment. A.C. and D.C. arc welding, Effect of polarity, current regulation and voltage regulation, Electrodes: Classification,

B.I.S. specification and selection, Flux for arc welding. Requirements of pre heating, post heating of electrodes and work piece. Welding defects and their testing methods.

UNIT IV

5. Lathe

Principle of turning, Description and function of various parts of a lathe. Classification and specification of various types of lathe, Drives and transmission, Work holding devices. Lathe tools: Parameters/Nomenclature and applications. Lathe operations - Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning. Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time. Speed ratio, preferred numbers of speed selection. Lathe accessories:- Centers, dogs, different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower

rest, taper turning attachment, tool post grinder, milling attachment, Quick change device for tools. Brief description of capstan and turret lathe, comparison of capstan/turret lathe, work holding and tool guiding devices in capstan and turret lathe.

UNIT V

6. Drilling

Principle of drilling. Classification of drilling machines and their description. Various operation performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping. Speeds and feeds during drilling, impact of these parameters on drilling, machining time. Types of drills and their features, nomenclature of a drill. Drill holding devices. Types of reamers.

7. Boring

Principle of boring, Classification of boring machines and their brief description. Specification of boring machines. Boring tools, boring bars and boring heads. Description ofjig boring machine.

8. Cutting Fluids and Lubricants

Function of cutting fluid, Types of cutting fluids, Difference between cutting fluid and lubricant, Selection of cutting fluids for different materials and operations, Common methods of lubrication of machine tools, Certifying Organizations (such as SAE, ASTM) forrating standards of lubricants.

RECOMMENDED BOOKS

1. B.S. Raghuwanshi, “A Course in Workshop Technology (Vol. I, Manufacturing Processes)’’, Dhanpat Rai and Sons, New Delhi, 2015.
2. B.S. Raghuwanshi, “A Course in Workshop Technology (Vol. II Machine Tools)”, Dhanpat Rai and Sons, New Delhi, 2017.
3. R. K. Jain, “Workshop Technology Vol I & II’’, Khanna Publishers, New Delhi, First Edition, 2021.
4. T. L. Choudhary, “Workshop Technology Part - 1 & 2”, Khanna Publishers, New Delhi, Sixth Edition, 2019.
5. S. K. Choudhry and Hajra, “Elements of Workshop Technology (Vol. I Manufacturing Processes)”, Media Promoters and Publishers Pvt. Ltd., 2008.
6. S. K. Choudhry, Hajra and Nirja Roy, “Elements of Workshop Technology (Vol. II Machine Tools)’’, Media Promoters and Publishers Pvt. Ltd., Fifteenth Edition, 2016.

7. P. C. Sharma, "A Text Book of Production Engineering'', S Chand and Company Ltd., Delhi, Eleventh Edition, 2013.
8. R. K. Jain, " Production Technology", New Delhi, Nineteenth Edition, 2019.
9. P. N. Rao, "Manufacturing Technology Volume –I '', Tata McGraw Hill, Delhi, FifthEdition, 2019.
10. P. N. Rao, "Manufacturing Technology Volume –II'', Tata McGraw Hill, Delhi, Fourth Edition, 2019.

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis in making students conversant with concepts and principles of manufacturing processes. This is theoretical subject and contains five units of equal weight age.

2.7 WORKSHOP PRACTICE - I

L	P
-	6

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. This course is included in the curriculum in order to provide hands-on experience about basic manufacturing practices. This subject aims at developing general manual skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

COURSE OUTCOMES

After completing the subject, the students will be able to:

CO1: Identify tools, equipment and materials used in preparing jobs.

CO2: Take measurements with the help of basic measuring tools/equipment.

CO3: Select materials, tools, and sequence of operations to make a job as per given specifications/drawing.

CO4: Prepare simple jobs independently and inspect the same.

CO5: Use safety equipment and Personal Protection Equipment (PPE).

CO6: Maintain good housekeeping practices.

DETAILED CONTENTS CUM PRACTICAL EXERCISES

The following shops are included in the syllabus.

1 Welding Shop – II
2 Fitting and Plumbing Shop – II
3 Carpentry Shop II
4 Smithy Shop
5 Electric and Electronics Shop II
6 Turning Shop

1. WELDING SHOP – II

1.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

1.2 Introduction to gas welding, gas welding equipment, introduction to soldering and brazing, introduction to resistance welding, safety precautions.

1.3 Identification and adjustment of various types of gas flames

1.4 Demonstration of brazing and gas cutting

1.5 Demonstration of Welding defects

1.6 Jobs to be prepared

Job I Beading Practice by gas welding.

Job II Preparation of lap joint on M.S. flat using gas welding.

Job III Preparation of double V butt joint/corner joint on M.S. flat using gaswelding / arc welding process

Job IV Preparation of pipe joint using gas/arc welding

Job V Preparation of a small cot frame/stool/table frame/drawing tableframe) using gas or arc welding.

2. FITTING AND PLUMBING SHOP – II

2.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

2.2 Handling of measuring instruments, Use of dial gauges and feeler gauges.

2.3 Demonstration of various types of drills, taps and dies.

2.4 Introduction to tapping and dieing

Job I To perform drilling and reaming operation on mild steel flat.

2.5 file and make angle, surfaces (Bevel gauge accuracy 1 degree) make simple open and sliding fits Inside square fit, make combined open and sliding fit, straight sides

Job II To make assembly for V shape or square shape fit.

Job III Radius form filing on the corners

2.6 Sliding fitting, Diamond fitting, Lapping flat surfaces using lapping plate. Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish

Job IV To make step assembly.

2.7 Introduction to various types of threads (internal and external)-single start, multi-start,left hand and right hand threads.

2.8 Description and demonstration of various types of drills, taps and dies. Selection ofdies for threading, selection of drills, taps and reamers for tapping operations.

2.9 Introduction to use of plumbing tools like pipe wrench , plumber vice and materials likePutty, thread, duct(Teflon) tape, epoxy resin, araldite, m-seal.

2.10 Precautions while drilling soft metals, e.g. copper, brass, aluminium etc.

Job V To make overhead tank assembly with GI/C-PVC pipes and joints.

3. CARPENTRY SHOP – II

3.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

3.2 Introduction to joints, their relative advantages and uses.

Job I To make a dovetail joint.

Job II To make a mitred joint.

Job III To make a lengthening joint by using different joints.

3.3 Demonstration of machines like Band Saw and Circular Saw, Chain and Chisel, Universal wood working machine, Saw re-sharpening machine, Saw Brazing unit.

3.4 Introduction and function of various parts of Wood Working Lathe

a) Study of wood working lathe tool.

b) Sharpening of lathe tools.

c) Setting of jobs and tools.

Job IV To make a job using different type of wood turning operations including form turning and grooving.

OR Repair of any utility item.

Job V To make a medium size wooden dust bin/ wooden tray.

4. SMITHY SHOP

4.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

4.2 Introduction and industrial applications of smithy jobs.

4.2.1 Purpose of Smithy shop.

4.2.2 Different types of Hearths used in Smithy shop, Types of fuel used and maximum temperature obtained.

4.2.3 Purpose, specifications, uses, care and maintenance of various tools and equipment used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools, punches etc.

4.2.4 Types of raw materials used in Smithy shop.

4.2.5 Uses of Fire Bricks and Clays in Forging workshop.

4.3 Practice

4.3.1 Practice of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.

4.3.2 Practice on different basic Smithy/Forging operations such as Cutting, Upsetting, Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting.

Demonstration of making cube, hexagonal cube, hexagonal bar from round bar

4.3.3 Practice of Simple Heat treatment processes like Tempering, Normalizing, and Hardening.

4.4 Introduction to various heat treatment processes e.g annealing, hardening, tempering, normalizing.

4.5 Description of various types of power hammers and their usage (Demonstrationonly).

4.6 Jobs to be prepared

Job I To forge a square/hexagonal shape on both endsfrom a MS round by cold forging

Job II To make a utility item like fan hook, ring, U type door handle

Job III To make a ring of MS round by forge welding

Job IV To make a hexagonal chisel by hot forging process withhardening and tempering

Job V To perform bending process by hot forging.

5. ELECTRICAL AND ELECTRONICS SHOP - II

5.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

5.2 Introduction to single phase and three phase supply and wiring system. Importance of three phase supply (RYB) and its sequence and wiring system. Estimating and costing of power consumption.

Job I Connecting single phase energy meter with supply and load. Reading and working out power consumption and cost of energy.

5.3 Study of internal wiring diagram of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Demonstration of dismantling, servicing and reassembling of table/ceiling fan, air-cooler, auto electric iron, heater etc.

Job II Connection of single phase/three phase motor by using starter. Reversing direction of rotation of single phase and three phase motors.

Job III Cut, bend, tin components, leads, inserts. Solder components for example resistor, capacitor, diode, transistor and other components ona PCB.

5.4 Demonstrate the joining for connecting methods mounting and dismounting method as well as using of the various plugs, sockets, conductors, suitable for general purpose, audio video used conductors, banana plugs, socket and similar male and female conductor and terminal strips

5.5 Various types of switches such as normal, miniature toggle, slide, push button.

Job IV Wiring of a small circuit on a PCB/ TAG strip involving laying, sleeving and use of identifier tags.

Job V Cut, strip, join and insulate two lengths of wires/cables.

Desoldering practice with desoldering pump and desoldering wick.

6. TURNING SHOP

6.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, best practices in the concerned shop.

6.2 Jobs to be Prepared

- Job 1 Centering practice in 4 jaw chuck, setting of cutting tool point at appropriate height and perform facing and plain turning operationson MS rod.
- Job II To sharpen various angles of turning tool.
- Job III To perform step turning on MS rod.
- Job IV To perform taper turning and under cutting operation.
- Job V To perform step turning and knurling operation on MS rod.

RECOMMENDED BOOKS

1. SK Hajra Choudhary and AK Choudhary, "Workshop Technology I, II, III", Media Promoters and Publishers Pvt. Ltd., Mumbai, Fifteenth Edition, 2016.
2. RK Jain, "Workshop Technology Vol I& II'', Khanna Publishers, New Delhi, First Edition, 2021.
3. Manchanda, "Workshop Technology Vol. I, II, III", India Publishing House, Jalandhar.
4. S.S. Ubhi, "Workshop Training Manual Vol. I, II'', Katson Publishers, Ludhiana.
5. K Venkata Reddy, "Manual on Workshop Practice", MacMillan India Ltd., New Delhi, Sixth Edition, 2020.
6. "General Workshop Manual (Diploma Jobs)", Khanna Publishers, First Edition, 2021.
7. T Jeyapoovan, "Basic Workshop Practice Manual", Vikas Publishing House (P) Ltd., New Delhi.
8. B. S. Raghuvanshi, "Workshop Technology, Vol. I", Dhanpat Rai and Sons, Delhi, Eleventh Edition, 2017.
9. Kannaiah K L, Narayana, "Workshop Manual", Scitech Publications, Chennai, Second Edition 1998.
10. H S Bawa, "Workshop Practice", Tata McGraw Hill Publication, First Edition, 2004

INSTRUCTIONAL STRATEGY

This is hands-on practice based workshop for development of required skills in the students.

SECOND YEAR

NSQF LEVEL - 4

12. STUDY AND EVALUATION SCHEME

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
3.1	Industrial/In-house Training-I	-	2	0+1=1	-	40	40	-	60	60	100
3.2	**Strength of Materials	3	2	3+1=4	40	40	80	60	60	120	200
3.3	Auto Engineering Drawing	-	4	0+2=2	-	40	40	60	-	60	100
3.4	Basics of Thermodynamics, Hydraulics and Pneumatics	3	2	3+1=4	40	40	80	60	60	120	200
3.5	**Workshop Technology - II	3	-	3+0=3	40	-	40	60	-	60	100
3.6	**Basics of Electrical and Electronics Engineering	2	-	2+0=2	40	-	40	60	-	60	100
3.7	Mechanical Workshop Practice –I	-	4	0+2=2	-	40	40	-	60	60	100
3.8	Automobile Workshop Practice	-	4	0+2=2	-	40	40	-	60	60	100
3.9	Open Elective (MOOCs+/Offline)	2	-	2+0=2	40	-	40	60	-	60	100
# Student Centered Activities(SCA)		-	4	-	-	-	-	-	-	-	-
	Total	**13**	**22**	**22**	200	240	440	360	300	660	1100

** Common with diploma in Mechanical Engineering

\+ Assessment of Open Elective through MOOCs shall be based on assignments out of 100 marks.

\# Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self- study etc.

FOURTH SEMESTER :

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
4.1	*English and Communication Skills - II	2	2	2+1=3	40	40	80	60	60	120	200
4.2	**Materials and Metallurgy	3	2	3+1=4	40	40	80	60	60	120	200
4.3	CNC Machines and Advanced Manufacturing Processes	3	-	3+0=3	40	-	40	60	-	60	100
4.4	Auto Engine - I	3	2	3+1=4	40	40	80	60	60	120	200
4.5	Chassis, Body and Transmission - I	3	2	3+1=4	40	40	80	60	60	120	200
4.6	Computer Aided Drafting for Automobile Engineering	-	4	0+2=2	-	40	40	-	60	60	100
4.7	Mechanical Workshop Practice II	-	4	0+2=2	-	40	40	-	60	60	100
# Student Centered Activities(SCA)			5	-	-	-	-	-	-	-	-
	Total	**14**	**21**	**22**	200	240	440	300	360	660	1100

* Common with other Diploma Courses

** Common with diploma in Mechanical Engineering

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

Industrial Training: After 4th Semester, students shall undergo Industrial Training of 4 Weeks.

13. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects	Hours Per Week	
		Third Semester	Fourth Semester
1.	Industrial/In-house Training I	2	-
2.	Strength of Materials	5	-
3.	Workshop Technology - II	3	-
4.	Basics of Thermodynamics, Hydraulics and Pneumatics	5	-
5.	Basics of Electrical and Electronics Engineering	2	-
6.	Auto Engineering Drawing	4	-
7.	Mechanical Workshop Practice –I	4	-
8.	Automobile Workshop Practice	4	-
9.	Open Elective (MOOCs/Offline)	2	-
10.	English and Communication Skills - II	-	4
11.	Materials and Metallurgy	-	5
12.	CNC Machines and Advanced Manufacturing Processes	-	3
13.	Auto Engine - I	-	5
14.	Chassis, Body and Transmission - I	-	5
15.	Computer Aided Drafting for Automobile Engineering	-	4
16.	Mechanical Workshop Practice II	-	4
17.	Student Centered Activities(SCA)	4	5
	Total	**35**	**35**

14. COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

Government and private sectors related to Automobile Engineering require **skilled workers** to work in familiar, predictable, routine situations of clear choice. They are expected to have factual knowledge of Automobile Engineering field. They will be able to write and speak with required clarity. Students after passing level 4 shall have understanding of basic arithmetic, algebraic principles along with basic understanding of social and natural environment. They are expected to recall and demonstrate quality skill in narrow range of applications using appropriate rules and tools.

Skilled workers will be responsible for carrying out a range of jobs, some of which will require them to make choices about the approaches they adopt. They will be expected to learn and improve their practice on the job. They should know what constitutes quality in the occupation and should distinguish between good and bad quality in the context of their job roles. Skilled worker at this level will be expected to carry out their work safely and securely and take full account of the health and safety on colleagues and customers. They should work hygienically and in ways which show an understanding of environmental issues. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social and political environment.

Automobile Engineering NSQF Level – 4 pass out students are expected have the knowledge of properties and testing of materials. They are expected to have good knowledge of thermodynamics, hydraulics and pneumatics. They are expected to have good knowledge and skills in drawing of automobile components. Level 4 pass out students should have good knowledge and skills regarding operation of various machines.

Automobile Engineering students have wide scope to work in automobile and auto ancillary industry. They also have good avenues to work in organizations such as State transport authorities, garages of municipal corporations and other public/private sector undertakings, maintenance department of heavy earth moving equipment, repair and maintenance of tractor and agriculture equipment in service centre. They have wide scope in establishing small startups in the area of marketing and sales, manufacturing units and repair and maintenance units etc.

15. PROGRAMME OUTCOMES

The program outcomes are derived from five domains of NSQF Level – 4 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this level, the student will be able to:

PO1: Carry out a task which may require limited range of predictable activities.

PO2: Acquire knowledge of basic facts, process and principles related to Automobile Engineering for employment.

PO3: Demonstrate Practical skill in narrow range of Automobile Engineering applications.

PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.

PO5: Perform task under close supervision with some responsibility for own work within defined limit.

PO6: Select open elective of own interest to develop self-learning through MOOCs.

14. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be Assessed	Assessment Criteria for the Course Outcomes
PO1: Carry out a task which may require limited range of predictable activities.	• Assist in testing an IC engine. • Take necessary safety precautions and measures. • Work in team for solving industrial problems • Develop competencies and skills required by relevant industries.
PO2: Acquire knowledge of basic facts, process and principles related to Automobile Engineering for employment.	• Understand the working environment of industries. • Learn about present and future requirement of industries. • Interpret various concepts and terms related to strength of materials • Calculate stresses in thin cylindrical shells. • Calculate energy stored by materials subjected to axial loads. • Calculate moment of inertia of different sections. • Draw and calculate bending moment and shear force diagrams of beam under given loading • Interpret the concept of bending and torsion and calculate stresses on different section of materials. • Calculate critical axial loads on column under different end constraints. • Determine the various parameters in closed coil helical and laminated springs. • Demonstrate applications of various welding processes. • Explain the process of pattern making, moulding and casting • Explain procedure of various types of NDT for welding and casting. • Explain the working of various machining processes such as shaping, planning, milling and broaching • Understand functions and operations of various jigs and fixtures. • Explain various thermodynamic processes • Describe Carnot cycle.

	• Apply Pascal's law to general engineering devices. • Verify Bernoulli's theorem • Explain working of hydraulic devices and machines. • Describe concepts of pneumatics. • Interpret various electrical quantities. • Improve power factor in a given circuit. • Explain construction, working principle, and applications of transformer. • Identify different wires of distribution system. • Describe the working of single phase and three phase motors. • Follow electrical safety measures. • List the applications of diodes and ICs. • Compare hole basis system with shaft basis system and choose fits and tolerances for various mating parts. • Distinguish between metals and non metals and ferrous and non ferrous materials. • Carryout various heat treatment processes. • Draw and interpret iron-carbon diagram. • Distinguish various grades of Stainless steel and the relative selection of fabrication process depending upon the metallurgy of SS • Classify various types of plastics and rubber. • Explain properties and applications of composites, ceramics and smart materials. • Select suitable material to be used for various engineering applications. • Describe the principle of working of non-conventional machining processes • Explain the working of CNC machines • Make part programs for CNC machines • Explain the principles of operation of an internal combustion engine • Classify various types of IC engine on various basis.

	• Explain the principles of operation of fuel supply systems • Explain the principles of operation of engine cooling and lubrication systems • Carryout servicing of lubrication and cooling system • Test I.C. engine. • Classify the vehicle • Identify major components of vehicles • Explain the function and working of clutch • Explain the function and working of transmission • Dismantle and assemble major assemblies of transmission • Describe the functional and constructional features of final drive and its components • Describe the functional and constructional features of front axles • Comprehend steering geometry and explain the working and constructional features of steering system
PO3: Demonstrate Practical skill in narrow range of Automobile Engineering applications.	• Understand the working environment of industries. • Take necessary safety precautions and measures. • Work in team for solving industrial problems • Develop competencies and skills required by relevant industries. • Perform various tests related to strength on various machines as per Indian Standards. • Measure temperature of hot surface. • Measure pressure of fluid. • Use pneumatic tools. • Prepare drawings of automotive components • Interpret various drawing used in automobile engineering • Carry out welding of parts.

	• Carry out pattern making, moulding and casting operations. • Prepare jobs on lathe and milling machine. • Analyze microstructure and changes in microstructure due to heat treatment. • Carryout various heat treatment processes. • Follow safety procedures in automobile workshop. • Identify and use general and special tools of auto shop. • Remove and refit simple outside components. • Wash the vehicles. • Make part programs for CNC machines • Carryout servicing of lubrication and cooling system • Test I.C. engine. • Dismantle and assemble major assemblies of transmission • Perform wheel alignment. • Draw and interpret automobile parts using 2 D commands in CAD software. • Create easy and complex solids and assemblies using various tools in CAD software. • Develop part program for lathe operations. • Develop part program for milling operations.
PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• Communicate effectively with an increased confidence; read, write and speak in English language fluently. • Comprehend special features of format and style of formal communication through various modes. • Write a Report, Resume, make a Presentation, Participate in GDs and Face Interviews • Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonal relationships.

PO5: Perform task under close supervision with some responsibility for own work within defined limit.	• Follow safety procedures in automobile workshop. • Take necessary safety precautions and measures. • Work in team for solving industrial problems • Develop competencies and skills required by relevant industries.
PO6: Select open elective of own interest to develop self-learning through MOOCs.	• State the basic concepts and principles about the subject of interest. • Perform in a better way in the professional world. • Select and learn the subject related to own interest. • Explore latest developments in the field of interest. • Develop the habit of self-learning through online courses.

17. SUBJECTS & CONTENTS

(SECOND YEAR)

THIRD SEMESTER

3.1	Industrial/In-house Training I	91-92
3.2	Strength of Materials	93-96
3.3	Auto Engineering Drawing	97-99
3.4	Basics of Thermodynamics, Hydraulics and Pneumatics	100-103
3.5	Workshop Technology - II	104-107
3.6	Basics of Electrical and Electronics Engineering	108-110
3.7	Mechanical Workshop Practice –I	111-112
3.8	Automobile Workshop Practice	113-114
3.9	Open Elective (MOOCs/Offline)	115-117

3.1 INDUSTRIAL/IN-HOUSE TRAINING- I

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-	2

RATIONALE

Industrial training / In – house training will help the students to understand the working environment of relevant industries. The student will learn to work in team to solve the industrial problems. It will also give exposure about the present and future requirements of the relevant industries. This training is very important for development of required competencies and skills for employment and start– ups.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1: Understand the working environment of industries
CO2: Take necessary safety precautions and measures.
CO3: Learn about present and future requirement of industries.
CO4: Work in team for solving industrial problems
CO5: Develop competencies and skills required by relevant industries.
CO6: Develop writing, speaking and presentations skills.

PRACTICAL EXERCISES

1. Report writing based on industrial training.
2. Preparation of Power Point Slides based on industrial training and presentation by the candidate.
3. Internal Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.
4. External Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.

GUIDELINES

Students will be evaluated based on Industrial training / In – house training report and their presentation using Power Point about the knowledge and skills gained during the training. The Head of the Department will depute faculty coordinators by assigning a group of students to each. The coordinators will mentor and guide the students in preparing the PPTs for final presentation. The following performance parameters are to be considered for assessment of the students out of 100 marks:

	Parameter	**Weightage**
i	Industrial / In-house assessment of the candidate by the trainer	40%
ii	Report Writing	20%
iii	Power Point Presentation	20%
iv	Viva-voce	20%

3.2 STRENGTH OF MATERIALS

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RATIONALE

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts, columns and springs. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

C01: Interpret various concepts and terms related to strength of materials
CO2: Calculate stresses in thin cylindrical shells.
CO3: Calculate energy stored by materials subjected to axial loads.
CO4: Calculate moment of inertia of different sections.
CO5: Draw and calculate bending moment and shear force diagrams of beam under given loading
CO6: Interpret the concept of bending and torsion and calculate stresses on different section of materials.
CO7: Calculate critical axial loads on column under different end constraints.
CO8: Determine the various parameters in closed coil helical and laminated springs
C09: Perform various tests related to strength on various machines as per Indian Standards.

DETAILED CONTENTS

UNIT I

1. Stresses and Strains

1.1. Basic concept of load, stress and strain
1.2. Tensile, compressive and shear stresses
1.3. Linear strain, Lateral strain, Shear strain, Volumetric strain.
1.4 Concept of Elasticity, Elastic limit and limit of proportionality
1.5 Hook's Law, Elastic Constants and their relation (without derivation)

1.6. Stress-strain curve for ductile and brittle materials
1.7 Nominal stress
1.8 Yield point, plastic stage
1.9 Ultimate stress and breaking stress
1.10 Percentage elongation
1.11 Proof stress and working stress
1.12. Factor of safety
1.13 Poisson's Ratio
1.14 Thermal stress and strain
1.15 Longitudinal and circumferential stresses in seamless thin walled cylindrical shells.
1.16 Introduction to Principal stresses

2. Resilience

2.1 Strain Energy, Resilience, proof resilience and modulus of resilience
2.2 Strain energy due to direct stresses and Shear Stress
2.3 Stresses due to gradual, sudden and falling load.

UNIT II

3. Moment of Inertia

3.1. Concept of moment of inertia and second moment of area
3.2 Radius of gyration
3.3 Theorem of perpendicular axis and parallel axis (with derivation)
3.4 Second moment of area of common geometrical sections: Rectangle, Triangle, Circle (without derivation); Second moment of area for L,T and I section
3.5 Section modulus

UNIT III

4. Bending Moment and Shearing Force

4.1 Various types of beams and form of loading
4.2 End supports-Roller, hinged and fixed
4.3 Concept of bending moment and shearing force
4.4 B.M. and S.F. Diagram for simply supported beam with and without overhang subjected to concentrated and U.D.L and cantilever beam.

UNIT IV

5. Bending Stresses

5.1 Concept of Bending stresses

5.2. Theory of simple bending, Derivation of Bending Equation

5.3. Use of the equation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$

5.4. Concept of moment of resistance

5.5. Bending stress diagram

5.6 Section modulus for rectangular, circular and symmetrical I section.

5.7. Calculation of maximum bending stress in beams of rectangular, circular, and T section.

6 Columns

6.1. Concept of column, modes of failure

6.2. Types of columns, modes of failure of columns

6.3. Buckling load, crushing load

6.4. Slenderness ratio

6.5. Effective length

6.6 End restraints

6.7 Factors effecting strength of a column

6.8 Strength of column by Euler Formula without derivation

6.9. Rankine Gourdan formula (without derivation)

UNIT V

7. Torsion

7.1. Concept of torsion, difference between torque and torsion.

7.2. Derivation of Torsion Equation, use of torsion equation for circular shaft, (solid and hollow)

7.3. Comparison between solid and hollow shaft with regard to their strength and weight.

7.4. Concept of mean and maximum torque

7.5 Power transmitted by shaft

8. Springs

8.1. Closed coil helical springs subjected to axial load and calculation of Stress deformation, Stiffness and angle of twist and strain energy, Strain energy and proof resilience.

8.2. Determination of number of plates of laminated spring (semi elliptical type only)

PRACTICAL EXERCISES

1. Tensile test on bars of Mild steel and Aluminum.
2. Bending test on a steel bar or a wooden beam.
3. Impact test on metals
   a) Izod test
   b) Charpy test
4. Torsion test of solid specimen of circular section of different metals for determining modulus of rigidity.
5. To plot a graph between load and extension and to determine the stiffness of a helical spring.
6. Hardness test on different metals.

Note : All the tests need to be done as per prescribed Indian Standards.

RECOMMENDED BOOKS

1. RS Khurmi, “Strength of Materials”, S.Chand & Co, New Delhi.
2. Dr. Kirpal Singh, “Mechanics of Materials”, Standard Publishers Distribution, New Delhi.
3. Birinder Singh, “Strength of Materials”, Katson Publishing House, New Delhi.
4. D.R. Malhotra and H.C.Gupta, “Elements of SOM”, Satya Prakashan, New Delhi.

INSTRUCTIONAL STRATEGY

This is hands-on practice based subject and topics taught in the class should be practiced in the lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

3.3 AUTO ENGINEERING DRAWING

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RATIONALE

An Automobile Engineering diploma holder, irrespective of his field of operation in an industry or transport undertaking, is expected to possess a thorough understanding of engineering drawing, which includes clear spatial visualization of the subject and the proficiency in reading and interpreting a wide variety of drawings. Besides this, he is also expected to have a certain degree of drafting skills depending upon his job functions to perform his day-to-day activities e.g. communicating and discussing the ideas with his superiors and passing on instructions to his subordinates in an unambiguous way. The teachers are recommended to lay emphasis on showing automobile components to students.

COURSE OUTCOMES

At the end of this course, the students will be able to

CO1: Prepare drawings of automotive components

CO2: Interpret various drawing used in automobile engineering

CO3: Compare hole basis system with shaft basis system and choose fits and tolerances for various mating parts.

PRACTICAL EXERCISES

UNIT I

1. Limits and Fits (01 sheet)

Limit, tolerance, Geometrical Tolerance, deviation, allowance, fits: clearance, interference, transition fit, Hole and shaft basis system.

2. Drawings of the following joints and bearings (03 sheets)
   - Universal joint assembly
   - Bush bearing
   - Ball bearing and Roller bearing

UNIT II

3. Drawing layout of the following Engine components (05 sheets)
   - Four Stroke Petrol Engine Piston
   - Diesel Engine Piston
   - Connecting rod
   - Fuel injector
   - Cam shaft and Crank shaft – 4 cylinder Engine

UNIT III

4. Drawing layout of following components/system (04 sheets)
   - Wheel cylinder and Master cylinder
   - Leaf Spring
   - Lighting circuit of a typical car
   - Side valve and overhead valve mechanism

UNIT IV

5. Cam Profile (4 sheets)
   - Different types of cams and followers
   - Drawing of cam profile for following motion of follower (without offset) :
     (a) Uniform velocity motion
     (b) Simple harmonic motion (SHM)
     (c) Uniformly accelerated and retarded motion.

UNIT V

6. Gears (3 sheets)

- Nomenclature of gears
- Profile of spur gear by 'Approximate method'
- Profile of spur gear by "Unwin's Method'

RECOMMENDED BOOKS

1. RB Gupta, "Auto Engineering Drawing", Satya Parkashan, New Delhi.
2. Raj Kumar, "Automobile Engg. Drawing", North Publication, Jalandhar.
3. PS Gill, "Machine Drawing", BD Kataria and Sons, Ludhiana.
4. Lakshminarayan, "Machine Drawing", Jain Brothers, New Delhi.
5. Dr. Kirpal Singh, "Automobile Engineering- Vol. I and II", Standard Publishers Distributors, Delhi.

INSTRUCTIONAL STRATEGY

Teacher should make use of models while explaining the details of drawing of various automobile parts and components. Emphasis should be laid on cleanliness and quality of drawings. This subject contains five units of equal weightage.

3.4 BASICS OF THERMODYNAMICS, HYDRAULICS AND PNEUMATICS

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RATIONALE

A diploma holder has to assist in activities of installation, operation and maintenance of thermal & hydraulic devices and pneumatic equipment. This subject has been included to impart basic knowledge of hydraulics, pneumatics and thermal engineering to the students.

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1: Explain various thermodynamic processes
CO2: Describe Carnot cycle.
CO3: Measure temperature of hot surface.
CO4: Apply Pascal's law to general engineering devices.
CO5: Verify Bernoulli's theorem
CO6: Measure pressure of fluid.
CO7: Explain working of hydraulic devices and machines.
CO8: Describe concepts of pneumatics.
CO9: Use pneumatic tools.

DETAILED CONTENTS

UNIT I

A. Thermodynamics

1. Introduction
1.1 Energy, work and heat
1.2 Thermodynamic state and system, boundary, surrounding, universe
1.3 Types of thermodynamic systems: closed, open, isolated, adiabatic
1.4 Thermodynamic properties: pressure, volume, temperature, enthalpy, internal energy, entropy

2. Gas Laws

2.1 Definition of gas,

2.2 Boyle's law, Charle's law, Joule's law, Avagadro's law, Regnault's law,

2.3 Ideal and real gas,

2.4 Characteristics equation, gas constant, universal gas constant.

2.5 Specific heat at constant pressure, specific heat at constant volume of gas,

2.6 Vander-Wall's equation

UNIT II

3. Laws of Thermodynamic

3.1 Zeroth law of thermodynamics (concept only).

3.2 First and second law of thermodynamics (concept only)

3.3 Steady flow energy equation,

3.4 Various thermodynamic processes - constant volume, constant pressure, isothermal, and free expansion processes; P-V & T-S diagrams (No Derivation)

4. Air Standard Cycle

4.1 Definition of heat engine cycle, Carnot cycle, net work done and air standard efficiency of Carnot cycle.

UNIT III

B. Hydraulics

5. Introduction

5.1 Fluids and non-fluids, Liquid, gas and vapour

5.2 Properties of fluids: Mass density, specific weight, pressure, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension, capillarity, Simple Numerical Problems

6. Fluid statics

6.1 Concept of pressure, static pressure and pressure head

6.2 Types of pressure: Atmospheric pressure, gauge pressure, vacuum, absolute pressure

6.3 Measurement of pressure: U tube manometer, Bourdon gauge

6.4 Pascal's law and its applications

UNIT IV

7. Flow of Fluids

7.1 Types of fluid flow: steady and unsteady, uniform and non - uniform, laminar and turbulent

7.2 Rate of flow and its units

7.3 Continuity equation of flow

7.4 Bernoulli's theorem (without proof) and its applications

7.5 Simple problems

8. Hydraulic Devices

8.1 Principle of working,

8.2 Layout of hydraulic system,

8.3 Various components of hydraulic system and function of each component,

8.4 Types of hydraulic pumps – reciprocating pump, centrifugal pump, gear type pump, screw pump, vane type pump and their working

8.5 Description, operation and application of hydraulic machines – hydraulic jack, hydraulic brake, hydraulic press.

UNIT V

PNEUMATICS

9. Introduction

9.1. Basic concept of pneumatics.

9.2. Layout of pneumatic system.

9.3. Various components of pneumatic system and their functions.

9.4. Construction and working of reciprocating and rotary air compressor.

9.5. Comparison of hydraulic system and pneumatic system.

10. Pneumatic tools

10.1. Construction and working of pneumatic gun.

10.2. Application of pneumatic gun as pneumatic screw driver, pneumatic wrench and pneumatic nut runner.

PRACTICAL EXERCISES

1. Measurement of temperature by thermocouple, pyrometer and infrared thermometer.
2. Measurement of pressure head by piezometer tube and manometer.
3. Verification of Bernoulli's theorem.

4. To study the hydraulic circuit of an automobile brake and hydraulic jack.
5. Demonstration of use of hydraulic press.
6. Dismantling and assembling of gear pump.
7. Demonstration of working of reciprocating air compressor.
8. Inflating and deflating of tyre, checking of air pressure in tyre.
9. Demonstration of layout of a pneumatic system/circuit used in garage.
10. Practice on pneumatic tools like pneumatic screw driver & pneumatic wrench.

Note: Safety precautions must be explained to the students before performing each practical.

RECOMMENDED BOOKS

1. RS Khurmi, "Hydraulics and Hydraulic Machines", S. Chand & Co. Ltd., New Delhi.
2. Jagdish Lal, "Hydraulics and Fluid Mechanics", Metropolitan Book Company Ltd., Delhi.
3. K.K. Arora, "Fluid Mechanic, Hydraulics and Hydraulic Machines", Standard Publishers Distributors, Delhi.
4. PK Nag, "Engineering Thermodynamics", Tata McGraw Hill, Delhi.
5. Roy Chaudhary, "Basic Engineering Thermodynamics", Tata McGraw Hill, Delhi.
6. PB Joshi and US Tumne, "Basic Thermodynamics", Pune Vidyarthi Grah Prakashan.
7. CP Arora, "Engineering Thermodynamics", Tata McGraw Hill, Delhi.
8. K Shammuga Sundaram, "Hydraulic and Pneumatic Control", S. Chand & Co. Ltd., New Delhi.
9. Festo Didactic, "Pneumatic Controls", Bangaluru.
10. K K Dhiman and Shaman Gupta,"Basics of Thermodynamics, Hydraulics and Pneumatics", Ishan Publishers, Jalandhar

INSTRUCTIONAL STRATEGY

This is hands-on practice based subject and topics taught in the class should be practiced in the lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

3.5 WORKSHOP TECHNOLOGY-II

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RATIOANLE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes is required to be imparted. Hence the subject of workshop technology.

COURSE OUTCOMES

After undergoing the subject, students will be able to:

CO1: Demonstrate applications of various welding processes.
CO2: Explain the process of pattern making, moulding and casting
CO3: Explain procedure of various types of NDT for welding and casting.
C04: Explain the working of various machining processes such as shaping, planning, milling and broaching
C05: Understand functions and operations of various jigs and fixtures.

DETAILED CONTENTS

UNIT I

1. Welding

Resistance welding: Principle, advantages, limitations, working and applications of spot welding and seam welding

Other Welding Processes: Principle, advantages, limitations, working and applications of Shielded metal arc welding, submerged arc welding. Welding defects, methods of controlling welding defects and inspection of welded joints.

Modern Welding Methods: Methods, Principle of operation, advantages, disadvantages and applications of, Tungsten inert gas (TIG) welding, Metal inert gas (MIG) welding, Thermit welding, Electro slag welding, Electron beam welding, Ultrasonic welding, Laser beam welding, Robotic welding

UNIT II

2. Foundry Techniques

2.1. Pattern Making

Types of pattern, Pattern material, Pattern allowances, Pattern codes as per B.I.S., Introduction to cores, core boxes and core materials, Core making procedure, Core prints, positioning of cores

2.2. Moulding and Casting

Moulding Sand: Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flowability, collapsibility, Various types of moulding sand, Testing of moulding sand.

Mould Making: Types of moulds, Step involved in making a mould, Molding boxes, hand tools used for mould making, Molding processes: Bench molding, floor molding, pit molding and machine molding.

Casting Processes: Charging a furnace, melting and pouring both ferrous and non ferrous metals, cleaning of castings, Principle, working and applications of Die casting: hot chamber and cold chamber, Centrifugal casting

Gating and Risering System: Elements of gating system, Pouring basin, sprue, runner, gates, Types of risers, location of risers, Directional solidification.

Melting Furnaces: Construction and working of Pit furnace, Cupola furnace, Crucible furnace – tilting type, Electric furnace

Casting Defects: Different types of casting defects, Non destructive testing (NDT) of castings: die penetration test, radiography, magnetic particle inspection and ultrasonic inspection.

UNIT III

3. Shaping, Slotting and Planing

3.1 Working principle and construction of shaper, slotter and planer
3.2 Type of shapers and slotters
3.3 Type of planers
3.4 Quick return mechanism applied to shaper and planer machine.
3.5 Work holding devices used on shaper and planer
3.6 Types of tools used and their geometry.
3.7 Specification of shaper and planer.

3.8 Speeds and feeds in above processes.

4 Broaching

4.1 Introduction to broaching

4.2 Nomenclature of broach tools, types and material

4.3 Types of broaching machines – single ram and duplex ram horizontal type, vertical type pull up, pull down and push down.

UNIT IV

5. Milling

5.1 Milling methods - up milling and down milling

5.2 Specification and working principle of milling machine

5.2 Classification, brief description and applications of milling machines

5.3 Details of column and knee type milling machine

5.4 Milling machine accessories and attachment – Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment, rotary table.

5.5 Identification of different milling cutters and work mandrels

5.7 Work holding devices

5.8 Milling operations – face milling, angular milling, form milling, straddle milling and gang milling.

5.9 Cutting parameters

UNIT V

6 Jigs and Fixtures

6.1 Importance and use of jigs and fixtures, difference between jig and fixture.

6.2 Principal of location

6.3 Locating and clamping devices

6.4 Types of jigs – drilling jig, template jig and plate jig

6.5 Types of fixtures – Milling and welding fixture

RECOMMENDED BOOKS

1. BS Raghuvanshi, “Workshop Technology”, Dhanpat Rai and Sons Delhi.
2. SK Choudhry and Hajra, “Elements of Workshop Technology”, Asia Publishing House.
3. RL Aggarwal and T Manghnani,”Welding Engineering”, Khanna Publishers, Delhi.
4. PC Sharma, “A Text Book of Production Engineering”, S Chand and Company Ltd. Delhi.

5. PN Rao, “Manufacturing Technology, Vol I and II”, Tata McGraw Hill, Delhi.
6. KP Sinha and DB Goel, “Foundry Technology”, Roorkee Publishing House, Roorkee.

INSTRUCTIONAL STRATEGY

Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes. Use of audio-visual aids/video films should be made to show specialized operations. This subject contains five units of equal weightage.

3.6 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

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RATIONALE

The objective of this course is to impart fundamental knowledge and skills regarding basic electrical and electronics engineering, which diploma holders will come across in their professional life. This course will provide the students to understand the basic concepts and principles of a.c. fundamentals, electromagnetic induction, transformers, motors, distribution system, domestic installation, electrical safety etc. The students will also learn basic electronics along with their applications.

COURSE OUTCOMES:

After undergoing this course, the students will be able to:

CO1: Interpret various electrical quantities.
CO2: Improve power factor in a given circuit.
CO3: Explain construction, working principle, and applications of transformer.
CO4: Identify different wires of distribution system.
CO5: Describe the working of single phase and three phase motors.
CO6: Follow electrical safety measures.
CO7: List the applications of diodes and ICs.

DETAILED CONTENTS

UNIT I

1. Basic Electrical Quantities

Definition of voltage, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit. Difference between ac and dc. Various applications of electricity.

2. AC Fundamentals

Electromagnetic induction-Faraday's Laws, Lenz's Law; Fleming's rules, Principles of a.c. Circuits; Alternating emf, Definition of cycle, frequency, amplitude and time period. Concept of electrical power, Concept of phase and phase difference. Concept of resistance, inductance and capacitance in simple a.c. circuit. Concept of three phase system; star and delta connections; voltage and current relationship (no derivation)

UNIT II

3. Transformer

Working principle and construction of single phase transformer, transformer ratio, emf equation, tapping of transformer, power transformer, auto transformer and distribution transformer (brief idea and difference between them), cooling of transformer, applications of various types of transformers.

4. Distribution System

Difference between high and low voltage distribution system, identification of three-phase wires, neutral wire and earth wire in a low voltage distribution system. Identification of voltages between phases and between one phase and neutral. Difference between three-phase and single-phase supply

UNIT III

5. Electric Motor

Description and applications of single-phase and three-phase motors. Introduction to DC motor and its applications, Difference between ac and dc motor, Connection and starting of three-phase induction motors by DOL and star-delta starter. Changing direction of rotation of a given 3 phase induction motor. Motors used for driving pump, compressor and e vehicles.

UNIT IV

6. Domestic Installation

Distinction between light-fan circuit and single phase power circuit, sub-circuits, various accessories and parts of domestic electrical installation. Different types of wires and their IS specification, Identification of wiring systems. Colour coding of electrical wires.

7. Electrical Safety

Electrical shock and precautions against shock, treatment of electric shock, concept of fuses and their classification, concept of earthing and various types of earthing, brief description of range of protective devices like MCB, ELCB, and RCB

UNIT V

8. Basic Electronics

Concept of semi conductor, types- P and N type. Diodes and their applications, Transistor – PNP and NPN. Their characteristics and uses. Introduction to integrated circuit (IC), Different types of ICs used in electric drives and their control circuit.

RECOMMENDED BOOKS

1. P.S. Dhogal, "Basic Electrical Engineering", Tata McGraw Hill Publishers, New Delhi.
2. B. L. Thareja, "A Text Book of Electrical Technology Vol. I and II", S Chand and Co., New Delhi.
3. J. B. Gupta, "Basic Electrical Engineering", S. Kataria and Sons, Delhi.
4. N.N. Bhargava and Kulshreshta, "Basic Electronics and Linear Circuits", Tata McGraw Hill, New Delhi.
5. S. K. Sahdev, "Electronic Principles", Dhanpat Rai and Sons, New Delhi.
6. V. K. Mehta, "Principles of Electrical and Electronics Engineering", S. Chand and Company Ltd.. New Delhi.

INSTRUCTIONAL STRATEGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. This subject contains five units of equal weightage.

3.7 MECHANICAL WORKSHOP PRACTICE -I

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RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, skills in operating various machines need to be developed. Hence this subject.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

C01: Carry out welding of parts.

C02: Carry out pattern making, moulding and casting operations.

CO3: Prepare jobs on lathe and milling machine.

PRACTICAL EXERCISES

General introduction to hand tools used in foundry, welding and pattern making and foundry shop.

Welding Shop

Job 1. Exercise on spot welding/seam welding

Job 2. Exercise on MIG welding

Job 3 Exercise on TIG welding

Pattern making

Job 1. Preparation of solid/single piece pattern.

Job 2. Preparation of two piece/split pattern

Job 3. Preparation of a self cored pattern

Job 4. Preparation of a core box.

Foundry Shop

Job 1. Preparation of mould with solid pattern on floor.

Job 2. Moulding and casting of a solid pattern of aluminum

Job 3. Preparing a mould of step pulley and also preparing core for the same.

Job 4. Testing of moisture contents and strength of moulding sand.

Machine Shop

Job 1 Produce a rectangular block using a milling machine with a side and face cutter
Job 2 Prepare a slot on one face using milling machine
Job 3 Exercise on milling machine with the help of a form cutter
Job 4 Exercise on milling machine to produce a spur gear

Advance Turning Shop

Job 1 Exercise on boring with the help of a boring bar
Job 2 Exercise on internal turning on lathe machine
Job 3 Exercise on internal threading on lathe machine.

INSTRUCTIONAL STRATEGY

Instructor should conduct classes of each Workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

3.8 AUTOMOBILE WORKSHOP PRACTICE

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RATIONALE

For an automobile technician, it is necessary to develop the skills of handling and use of tools for servicing, repair and maintenance of the vehicle. The automobile workshop practice imparts basic knowledge of tools and vehicles as a base for the learner to be able to accomplish complex jobs. Some hands on practice will also enhance the skill.

COURSE OUTCOMES

At the end of this course, the students will be able to:
CO1: Follow safety procedures in automobile workshop.
CO2: Identify and use general and special tools of autoshop.
CO3: Remove and refit simple outside components.
CO4: Wash the vehicles.

PRACTICAL EXERCISES

1. General safety procedures to be followed in automobile workshop; and familiarization to safety equipment and their uses.
2. Identification and sketching of general tools of automobile workshop and practice to use them.
3. Identification and sketching of special purpose tools and gauges of automobile workshop.
4. Identification of IC engine components and chassis components.
5. Cleaning of spark plug and gap adjustment.
6. Removal and fitting of wheels and tyres of a two wheeler and repairing of punctures of tube.
7. Removal and fitting of wheels and tyres of car/jeep, tyre pressure measurement, repair of punctures of tubeless tyres.
8. Washing, greasing, wiping and polishing of a vehicle.
9. Removal, greasing and refitting of wheel bearing.
10. Replacement of clutch wire and brake wire and transmission chain adjustment of a two wheeler.

11. Removal and refitting of radiator and water hoses.
12. Removal and refitting of battery.

RECOMMENDED BOOKS

1. Arthur W. Judge, “Car Maintenance and Repair”.
2. Kirpal Singh, “Automobile Engineering Vol. 1”.

INSTRUCTIONAL STRATEGY

Instructor should conduct classes of each Workshop explaining use of tools, jobs to be made and safety precautions prior to students being exposed to actual practicals.

3.9 OPEN ELECTIVE

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RATIONALE

Open electives are very important and play major role in implementation of National Education Policy. These subjects provide greater autonomy to the students in the curriculum, giving them the opportunity to customize it to reflect their passions and interests. The system of open electives also encourages cross learning, as students pick and choose subjects from the different streams.

COURSE OUTCOMES

At the end of the open elective, the students will be able to:

CO1: State the basic concepts and principles about the subject of interest.

CO2: Perform in a better way in the professional world.

CO3: Select and learn the subject related to own interest.

CO4: Explore latest developments in the field of interest.

CO5: Develop the habit of self-learning through online courses.

LIST OF OPEN ELECTIVES
(The list is indicative and not exhaustive)

1. Computer Application in Business
2. Introduction to NGO Management
3. Basics of Event Management
4. Event Planning
5. Administrative Law
6. Introduction to Advertising
7. Moodle Learning Management System
8. Linux Operating System

9. E-Commerce Technologies
10. NCC
11. Marketing and Sales
12. Graphics and Animations
13. Digital Marketing
14. Human Resource Management
15. Supply Chain Management
16. TQM

GUIDELINES

Open Elective shall be offered preferably in online mode. Online mode open elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, KhanAcademy or any other online portal to promote self-learning. A flexible basket of large number of open electives is suggested which can be modified depending upon the availability of courses at suggested portals and requirements. For online open electives, department coordinators shall be assigned to monitor and guide the group of students for selection of minimum 20 hours duration online course of their choice. For offline open electives, a suitable relevant subject shall be offered by the respective department to the students with minimum 40% of the total class strength as per present and future requirements.

Assessment of MOOCs open elective shall be based on continuous evaluation by the respective coordinator. The coordinator shall consider the submitted assignments by the students from time to time during the conduct of MOOCs. The MOOCs assessment shall be conducted by the coordinator along with one external expert by considering submitted assignments out of 100 marks.

In case, no suitable open elective is available online, only then the course may be conducted in offline mode. The assessment of offline open elective shall be internal and external. The offline open elective internal assessment of 40 marks shall be based on internal sessional tests; assignments etc. and external assessment of 60 marks shall be based on external examination at institute level.

NOTE

The students enrolled under NCC will compulsorily undertake NCC as an open elective subject.

SUGGESTED WEBSITES

1. https://swayam.gov.in/
2. https://www.udemy.com/
3. https://www.upgrad.com/
4. https://www.khanacademy.org/

FOURTH SEMESTER

4.1	English and Communication Skills - II	118-122
4.2	Materials and Metallurgy	123-126
4.3	CNC Machines and Advanced Manufacturing Processes	127-129
4.4	Auto Engine - I	130-133
4.5	Chassis, Body and Transmission - I	134-137
4.6	Computer Aided Drafting for Automobile Engineering	138-140
4.7	Mechanical Workshop Practice II	141-141

4.1 ENGLISH AND COMMUNICATION SKILL - II

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2	2

RATIONALE

Communication II moves a step further from Communication Skills I and is aimed at enhancing the linguistic competency of the students. Language as the most commonly used medium of self-expression remains indispensable in all spheres of human life – personal, social and professional. This course is intended to make fresh ground in teaching of Communicative English as per the requirements of National Skill Quality Framework.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Communicate effectively with an increased confidence; read, write and speak in English language fluently.

CO2: Comprehend special features of format and style of formal communication through various modes.

CO3: Write a Report, Resume, make a Presentation, Participate in GDs and Face Interviews

CO4: Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonal relationships.

DETAILED CONTENTS

UNIT I

Reading

1.1 Portrait of a Lady - Khushwant Singh

1.2 The Doctor's Word by R K Narayan

1.3 Speech by Dr Kiran Bedi at IIM Indore2007 Leadership Concepts

1.4 The Bet - by Anton Chekov

UNIT II

Effective Communication Skills

2.1 Modern means of Communication (Video Conferencing, e- mail, Teleconferencing)

2.2 Effective Communication Skills: 7 C's of Communication

2.3 Non-verbal Communication – Significance, Types and Techniques for Effective Communication
2.4 Barriers and Effectiveness in Listening Skills
2.5 Barriers and Effectiveness in Speaking Skills

Unit III

Professional Writing

3.1 Correspondence: Enquiry letters, placing orders, complaint letters
3.2 Report Writing
3.3 Memos
3.4 Circulars
3.5 Press Release
3.6 Inspection Notes and tips for Note-taking
3.7 Corrigendum writing
3.8 Cover Letter

UNIT IV

Grammar and Vocabulary

4.1 Prepositions
4.2 Conjunctions
4.3 Punctuation
4.4 Idioms and Phrases: A bird of ill omen, A bird's eye view, A burning question, A child's play, A cat and dog life, A feather in one's cap, A fish out of water, A shark, A snail's pace, A snake in the grass, A wild goose chase, As busy as a bee, As faithful as dog, Apple of One's eye, Behind one's back, Breath one's last, Below the belt, Beat about the bush, Birds of a feather flock together, Black Sheep, Blue blood, By hook or crook, Chicken hearted, Cut a sorry figure ,Hand in glove, In black and white, In the twinkling, In full swing ,Is blind as a bat, No rose without a thorn, Once in a blue moon, Out of the frying pan in to the fire, know no bounds ,To back out, To bell the cat, To blow one's trumpet, To call a spade a spade, To cut one's coat according to one's cloth, To eat humble pie, To give ear to, To have a thing on one's finger tips, To have one's foot in the grave, To hold one's tongue, To kill two birds with one stone, To make an ass of oneself, To put two and two together, To the back bone, Turn coat, ups and downs.
4.5 Pairs of words commonly misused and confused: Accept-except, Access-excess, Affect-effect, Artificial- artful, Aspire-expire, Bail-bale, Bare-bear, Berth-birth, Beside-besides, Break-brake, Canvas-canvass, Course- coarse, Casual-causal, Council-counsel, Continual-continuous, Coma-comma, Cue- queue, Corpse- corps-core, Dairy-diary, Desert-dessert, Dual-duel, Dew- due, Die-dye, Draft- draught-drought, Device-devise, Doze-dose, Eligible-illegible, Emigrant-

immigrant, Envelop-envelope, Farther-further, Gate-gait, Goal-goal, Human-humane, Honorable-honorary, Hail-hale, Hair-heir-hare, Industrial-industrious, Impossible- impassable, Idle-idol-ideal, Lose-loose, Later-latter, Lesson-lessen, Main-Mane, Mental-mantle, Metal-mettle, Meter-metre, Oar-ore, Pray- prey, Plain-plan, Principal - principle, Personal- personnel, Roll- role, Route-rout- roote, Stationary-stationery, Union- unity, Urban- urbane, Vocation-vacation, Vain- vein-vane, Vary- very.

4.6 Translation of Administrative and Technical Terms in Hindi or Mother tongue: Academy, Abandon, Acting in official capacity, Administrator, Admission, Aforesaid, Affidavit, Agenda, Alma Master, Ambiguous, Appointing Authority, Apprentice, Additional, Advertisement, Assistant, Assumption of charge, Assurance, Attested copy, Bonafide, Bond, Cashier, Chief Minister, Chief Justice Clerical error, Commanding ,Officer, Consent, Contractor, corruption, Craftsman, Compensation, Code, Compensatory allowance, Compile, Confidential letter, Daily Wager, Data, Dearness allowance, Death - Cum Retirement, Dispatch, Dispatch Register, Disciplinary, Disciplinary Action, Disparity Department, Dictionary, Director, Director of Technical Education, Earned Leave, Efficiency Bar, Estate, Exemption, Executive Engineer, Extraordinary, Employment Exchange, Flying Squad, General Body, Head Clerk, Head Office, High Commission, Inconvenience, Income Tax, Indian Assembly Service, Justify, Legislative Assembly, Negligence, Officiating ,Office Record, Office Discipline, On Probation, Part Time, Performance, Polytechnic, Proof Reader Precautionary, Provisional, Qualified, Regret, Responsibility, Self-Sufficient, Senior, Simultaneous ,Staff, Stenography ,Superior, Slate, Takeover, Target Data Technical Approval, Tenure, Temporary, Timely Compliance, Under Investigation, Under Consideration, Verification, Viva-voce, Write off, Working Committee, Warning, Yours Faithfully , Zero Hour.

UNIT V

Employability Skills

5.1 Presentation Skills: How to prepare and deliver a good presentation

5.2 Telephone Etiquettes

5.3 Importance of developing employable and soft skills

5.4 Resume Writing: Definition, Kinds of Resume, Difference between Bio-data and Curriculum Vitae and Preparing a Resume for Job/ Internship

5.5 Group discussions: Concept and fundamentals of GD, and learning Group Dynamics.

5.6 Case Studies and Role Plays

PRACTICAL EXERCISES

1. Reading Practice of the above lessons in the Lab Activity classes.
2. Comprehension exercises of unseen passages along with the given lessons.

3. Vocabulary enrichment and grammar exercises based on the above selective readings.
4. Situational Conversation: Requesting and responding to requests; Expressing sympathy and condolence.
5. Warning; Asking and giving information.
6. Getting and giving permission.
7. Asking for and giving opinions.
8. A small formal and informal speech.
9. Seminar.
10. Debate.
11. Interview Skills: Preparing for the Interview and guidelines for success in the Interview and significance of acceptable body-language during the Interview.
12. Written Drills will be undertaken in the class to facilitate a holistic linguistic competency among learners.
13. Participation in a GD, Functional and Non-functional roles in GD, Case Studies and Role Plays
14. Presentations, using audio-visual aids (including power-point).
15. Telephonic interviews, face to face interviews.
16. Presentations as Mode of Communication: Persuasive Presentations using multi-media aids.
17. Practice of idioms and phrases on: Above board , Apple of One's eye , At sea, At random, At large, A burning question, A child's play, A wolf in sheep's clothing, A deal, Breath one's last, Bid fair to, Beat about the bush, Blue Blood, Big Gun, Bring to Book, Cut a sorry figure, Call names, Carry weight, Dark Horse, Eat Humble pie, Feel small, French leave, Grease the palm, Go against the grains, Get One's nerves, Hard and Fast, Hue and Cry, Head and ears, In full swing, Jack of all trades, know no bounds, kiss the dust, Keep an eye on, Lion's share, learn by rote, Null and void, on the cards, Pull a long face, Run amuck, Right and Left, Rain on Shine, Small talk, Take to one's heels, Tooth and nail, to take by storm, , Wet blanket, Yearn for.

RECOMMENDED BOOKS

1. Alvinder Dhillon and Parmod Kumar Singla, "Text Book of English and Communication Skills Vol – 1, 2", M/s Abhishek Publications, Chandigarh.
2. J Sethi, Kamlesh Sadanand & DV Jindal, "Course in English Pronunciation", PHI Learning Pvt. Ltd., New Delhi.
3. Wren and Martin, "High School English Grammar and Composition" .
4. NK Aggarwal and FT Wood, "English Grammar, Composition and Usage", Macmillan Publishers India Ltd., New Delhi.
5. RC Sharma, and Krishna Mohan, "Business Correspondence & Report Writing", (4th Edition), by Tata MC Graw Hills, New Delhi.

6. Varinder Kumar, Bodh Raj & NP Manocha, "Business Communication Skills", Kalyani Publisher, New Delhi.
7. Kavita Tyagi & Padma Misra, "Professional Communication", PHI Learning Pvt. Ltd., New Delhi.
8. Nira Konar, "Communication Skills for Professionals", PHI Learning Pvt. Ltd., New Delhi.
9. Krishna Mohan & Meera Banerji, "Developing Communication Skills", (2nd Edition), Macmillan Publishers India Ltd., New Delhi.
10. M. Ashraf Rizwi, "Effective Technical Communication", Tata MC Graw Hills, New Delhi.
11. Andrea J Rutherford, "Basic Communication Skills for Technology", Pearson Education, New Delhi.
12. "English and Communication Skills Vol-1,2" by Dr. Sangeeta, Jashanpreet Kaur; Anant Publications, Ambala City.

INSTRUCTIONAL STRATEGY

This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. Emphasis should be given on practicing of communication skills. This subject contains five unit of equal weight age.

4.2 MATERIALS AND METALLURGY

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RATIONALE

Lot of development has taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in this course are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and non ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in industries.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

C01: Distinguish between metals and non metals and ferrous and non ferrous materials.
C02: Analyze microstructure and changes in microstructure due to heat treatment.
C03: Carryout various heat treatment processes.
C04: Draw and interpret iron-carbon diagram.
C05: Distinguish various grades of Stainless steel and the relative selection of fabrication process depending upon the metallurgy of SS
C06: Classify various types of plastics and rubber.
C07 Explain properties and applications of composites, ceramics and smart materials.
C08 Select suitable material to be used for various engineering applications.

DETAILED CONTENTS

UNIT I

1. Introduction

Material: Engineering materials, Overview of different engineering materials and applications, Importance, Classification of materials, Difference between metals and non-metals, Overview of Biomaterials and semi-conducting materials

UNIT II

2. Crystallography

Fundamentals: Crystalline solid and amorphous solid, Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic Packing Factor, coordination number (without derivation), Defects/Imperfections, types and effects in Solid materials.

Deformation: Overview of deformation behaviour and its mechanisms, Elastic and Plastic deformation. Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep.

3. Metallurgy

Introduction, Cooling curves of pure metals, dendritic solidification of metals, effect of grain size on mechanical properties, Binary alloys, Thermal equilibrium diagrams, Lever rule, Solid Solution alloys

UNIT III

4. Metals and Alloys

Ferrous Metals: Different iron ores, Flow diagram for production of iron ,steel and stainless steel, allotropic forms of iron- Alpha, Delta, Gamma. Basic process of manufacturing of pig iron and steel-making.

Cast Iron: Properties, types of Cast Iron, manufacture and their use.

Steels: Plain carbon Steels and alloy steel, Classification of plain carbon steels, Properties and application of different types of Plain Carbon Steels, Effect of various alloying elements on properties of steel, Uses of alloy steels (high speed steel, silicon steel, spring steel)

Stainless steel: Definition, importance and criticality (Life cycle cost, Corrosion impact; difference with Steel, Per Capita consumption; growth rate of SS vs other materials, World vs India). Various grades of SS and their nomenclature, Effect of alloying elements, Unique characteristics of various grades of SS

Manufacturing of SS: Process flow, Raw materials for SS manufacturing functions of each processing unit, Downstream facilities, Various finishes of SS.

Fabrication and testing of SS: Stud welding method, Weldability and effect of welding on various types of SS, Defects like Sensitization and microfissure, Relative observations and precautions while performing the processes: cutting , Buffing, Bending, Roll forming, Embossing, Polishing of Stainless steel. Chemical treatment like pickling and passivation for SS.

Applications of SS : Demand of SS in various segments, Overview of SS applications in Automobile, railway, and transport. Architectural, building construction applications and Process Industries.

Non Ferrous Materials: Properties and uses of Copper, Aluminium and their alloys

UNIT IV

5. Heat Treatment

Definition and objectives of heat treatment, Iron carbon equilibrium diagram, different microstructures of iron and steel. Formation and decomposition of Austenite, Martensitic Transformation. Various heat treatment processes- hardening, tempering, annealing, normalizing, surface hardening, carburizing, nitriding, cyaniding. Hardenability of Steels

Types of heat treatment furnaces (only basic idea), measurement of temperature of furnaces.
Physical metallurgy of Stainless Steel; Various phases in SS, Chromium-Nickel diagram, Schaeffler Diagram

UNIT V

6. Advanced Materials

Heat Insulating materials- Asbestos, glasswool, thermocole.
Refractory materials –Dolomite, porcelain.
Glass – Soda lime, borosil.
Materials for bearing metals Materials for Nuclear Energy
Smart materials- properties and applications.

PRACTICAL EXERCISES

1. Classification of about 25 specimens of materials/machine parts into

(i) Metals and non metals
(ii) Metals and alloys
(iii) Ferrous and non ferrous metals
(iv) Ferrous and non ferrous alloys

2. Given a set of specimen of metals and alloys (copper, brass, aluminium, cast iron, HSS, **SS**, Gun metal); identify and indicate the various properties possessed by them.

3. a) Study of heat treatment furnace.
   b) Study of a thermocouple/pyrometer.

4. Study of a metallurgical microscope and a specimen polishing machine.

5. To prepare specimens of following materials for microscopic examination and to Examine the microstructure of the specimens of following materials (At least any two): i) Brass ii) Copper iii) Cast Iron, iv) Mild Steel v) HSS, vi) Aluminium vii) Stainless steel

6. To anneal a given specimen and find out difference in hardness as a result of annealing.

7. To normalize a given specimen and to find out the difference in hardness as a result of normalizing.

8. To harden and temper a specimen and to find out the difference in hardness due to tempering.

9. Demo of welding defects like sensitization and microfissure in stainless steel.

RECOMMENDED BOOKS

1. R.K. Rajput, "Text book of Material Science", Katson Publishers, Ludhiana.
2. V.K. Manchanda and GBS Narang, "Text book of Material Science", Khanna Publishers, New Delhi.
3. A.R. Gupta, "Introduction to Material Science", Satya Prakashan, New Delhi.
4. S. K. Hazra Chaudhary, "Material Science and Processes", India Book Distribution Co., Calcutta, First Edition, 1977.

INSTRUCTIONAL STRATEGY

While imparting instructions, teacher should show various types of engineering materials to the students. Visits to industry should be planned to demonstrate use of various types of materials or heat treatment processes in the industry. This is hands-on practice based subject and topics taught in the class should be practiced in the lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

4.3 CNC MACHINES AND ADVANCED MANUFACTURING PROCESSES

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RATIONALE

Newer manufacturing methods are being used in industry to enhance productivity and quality of the product. So it becomes necessary for the students to learn these advanced methods of manufacturing, hence the subject has been introduced.

COURSE OUTCOMES

After undergoing through this subject, the students will be able to:
CO1: Describe the principle of working of non-conventional machining processes
CO2: Explain the working of CNC machines
CO3: Make part programs for CNC machines
CO4: Introduce the concept of robotics

DETAILED CONTENTS

UNIT I

1. Introduction to Computer Numerical Control
1.1. Introduction - NC, CNC, DNC; Advantages and Application of CNC.
1.2. Working principle of CNC machine,
1.3. Basic components of CNC machines,
1.4. Types of CNC machines,
1.5. Motion control system - point to point, straight line, Continuous path (Contouring)
1.6. The coordinate system in CNC – cartesian and polar,
1.7. Coordinate data input – absolute and incremental,
1.8. Axis identification

UNIT II

2. Part Programming
2.1. Introduction to Part programming,
2.2. Basic concepts of part programming, NC words,

2.3. Part programming formats,
2.4. Linear and circular interpolation
2.5. Simple programs for drilling and turning
2.6. Tool off sets, cutter radius compensation and tool wear compensation.

UNIT III

3. CNC Machines
3.1. Working principle of CNC lathe and milling machine
3.2. Constructional details of CNC lathe and milling machine
3.3 Simple Part programs for CNC lathe and milling machine

UNIT IV

4 Advanced Machining Processes
4.1 Mechanical Process - Ultrasonic machining (USM): Introduction, principle, process, advantages and limitations, applications
4.2 Electro Chemical Processes - Electro chemical machining (ECM) – Fundamental principle, process, applications
4.3 Electrical Discharge Machining (EDM) - Introduction, basic EDM circuit, Principle, metal removing rate, dielectric fluid, applications
4.4 Laser beam machining (LBM) – Introduction, machining process and applications
4.5 Electron beam machining (EBM) - Introduction, principle, process and applications

UNIT V

5. Industrial Robotics
5.1 Definition
5.2 Laws of robotics
5.3 Robot configurations
5.4 Basic robot motions
5.5 Robotic sensors
5.6 Industrial applications

RECOMMENDED BOOKS

1. M Adithan and BS Pabla, “CNC Machines – Programming and Applications”, New Age International (P) Ltd., Delhi.
2. M.S. Sehrawat and J.S. Narang, “CNC Machines”, Dhanpat Rai and Co., New Delhi.

3. Rao, Kundra and Tiwari, “Computer Aided Manufacturing”, Tata Mc Graw Hill, New Delhi.
4. Bharaj, “CNC Machine”, Satya Publications, New Delhi.
5. Pandey, “Modern Machining Processes”, Tata McGraw Publishers, New Delhi.
6. P.C. Sharma, “A Text Book of Production Engineering”, S. Chand and Company Ltd., New Delhi.
7. R.P. Dhiman, “Workshop Technology Vol-III”, Ishan Publications Jalandhar.
8. T.C. Manjunath, “Fundamentals of Robotics”, Nandu Publishers, Mumbai.
9. Shaman Gupta, “Advanced Manufacturing Processes”, Ishan Publications, Jalandhar

INSTRUCTIONAL STRATEGY

The advanced machining processes can be explained through videos. This is highly practice-based course. Efforts should be made to develop programming skills amongst the students. During practice work, it should be ensured that students get opportunity to individually perform practical tasks.

4.4 AUTO ENGINE - I

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3	2

RATIONALE

Engine forms the base of Automobile Engineering. As the scope of auto engines is very wide, it has been divided into two subjects, Auto Engine –I and Auto Engine-II. This subject deals with engine terminology, basic concept of 2 stroke and 4 stroke engine, classification of engines, constructional details of petrol engine, fuel system, cooling system, lubrication system and ignition system.

COURSE OUTCOMES

On completion of this course, a learner should be able to:
CO1: Explain the principles of operation of an internal combustion engine
CO2: Classify various types of IC engine on various basis.
CO3: Explain the principles of operation of fuel supply systems
CO4: Explain the principles of operation of engine cooling and lubrication systems
CO5: Carryout servicing of lubrication and cooling system
CO6: Test I.C. engine.

DETAILED CONTENTS

UNIT I

1. Introduction

1.1 Engines: Concept of internal and external combustion engines and their comparison; Engine terminology including Bore, Stroke, dead centres, swept volume, clearance volume, compression ratio, Engine speed and piston speed, Crank shaft throw. Engine capacity, Engine torque, Indicated power, Brake power, Friction power.

1.2 Classification of engines as per stroke, cycle, fuel, ignition, cooling, speed, number and arrangement of cylinders, governing, reciprocating and rotary. Concept of 2-stroke and 4-stroke engines and their comparison. Concept of S.I. and C.I. engine and their comparison.

UNIT II

2. Engine Components

2.1 Construction details, material, specifications, functions and working of components: cylinder block, head, cylinder liner, piston, piston rings, gudgeon pin, connecting rod, crankshaft, camshaft, valves and valve mechanism, flywheel and dampers.

2.2 Valve timing diagram of SI engine and CI engine.

3. IC Engine Testing

3.1 Testing of I.C. engine and determination of Indicated Power, Brake Power. Mechanical Efficiency, Volumetric efficiency, Thermal Efficiency, Relative Efficiency, Mean Effective Pressure and Specific fuel consumption.

3.2 Heat balance sheet, Morse Test, vacuum test and compression test.

UNIT III

4. Fuel System in Spark Ignition Engine

4.1 Fuel System: types of fuel feed system: gravity and pump feed system. Fuel injection system.

4.2 Fuel tank, fuel lines, fuel filters.

4.3 Carburetion; working of simple carburetor, its function and limitations.

4.4 Working of AC Mechanical fuel pump and electrical fuel pump.

4.5 Fuel gauges – working of balanced coil and bi-metallic type

4.6 Air cleaners : construction, working and use of dry and wet type.

4.7 Intake and exhaust manifold; mufflers.

4.8 Petrol Injection: Introduction, comparison with carburetor method.

4.9 Description and working of multipoint fuel injection (MPFI) system.

4.10 Advantages and disadvantages of MPFI.

4.11 Various sensors used in MPFI.

UNIT IV

5. Ignition system

5.1 Concept of ignition system, ignition timing

5.2 Types of ignition system : Battery/coil and magneto ignition system

5.3 Function and working of ignition coil, distributor, condenser and spark plug

5.4 Contact breaker Point and gap

5.5 Spark plug and gaps pertaining to Indian vehicles

5.6 Concept of spark advance

5.7 Distributor less Ignition System and electronic ignition system.

5.8 Working of pulse generator, Hall effect switch, and optical switch

UNIT V

6. Cooling System
6.1 Cooling system: necessity, types (air cooling, water cooling)
6.2 Pump circulation cooling
6.3 Advantages and disadvantages of air cooling and water cooling
6.3.1 Components of water cooling system: radiators, thermostat, water pump, fan, pressure cap, temperature gauge, water jackets
6.4 Anti-freeze solution
6.5 Trouble shooting and remedies.

7. Lubrication System
7.1 Necessity of lubrication
7.2 Types of Lubrication system: Splash type & Pressure type, wet and dry sump
7.3 Components of lubrication system : oil pump, oil lines, oil filters, oil coolers
7.4 Characteristics, classification and SAE ratings/grades of lubricating oil
7.5 Additives for lubricants, Properties of lubricants

PRACTICAL EXERCISES

1. Demonstration of working of two stroke engine on a cut section model.
2. Demonstration of working of four stroke engine on a cut section model.
3. Demo of conventional and MPFI fuel feed systems.
4. Testing and setting of ignition timing with timing light.
5. Study of valve mechanisms and identification of various parts.
6. To find IHP, BHP and mechanical efficiency of multi-cylinder petrol engine using Morse Test Rig.
7. Demo of mechanical and electrical fuel feed pump.
8. Servicing of water cooling system – removal, flushing and testing of radiator; replacement of water hoses
9. Servicing of lubrication system, changing engine oil and oil filter.

Note: Safety precautions and cleanliness must be practised in each practical.

RECOMMENDED BOOKS

1. Dr. Kirpal Singh, "Automobile Engineering – Vol. I and II", Standard Publishers Distributors, Delhi.
2. R.B. Gupta, "Automobile Engineering", Satya Prakashan, New Delhi.
3. Srinivasan, "Automotive Engines", TMH, Delhi
4. Chikara, "Automobile Engineering", Dhanpat Rai and Sons, New Delhi.
5. KM Gupta, "Automobile Engineering", Umesh Publishers, Delhi.
6 G.S. Aulakh, "Auto Engine –I", Eagle Prakashan, Jalandhar.
7 G.S. Sethi, "Automobiles- Theory and Assignment Test (Solved)", Asian Publishers, New Delhi.
8. Even Shekhri, "Auto Engine I", Ishan Publications, Jalandhar.

INSTRUCTIONAL STRATEGY

The teacher should lay emphasis in making the students conversant with the principles and practices related to various types of engines. Audio visual aids should be used to show engine features and working. Demonstrations should be made in automobile shop to explain various engine components.

4.5 CHASSIS, BODY AND TRANSMISSION - I

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3	2

RATIONALE

Chassis, body and transmission form the core of automobile engineering. The subject focuses at imparting knowledge and skills regarding chassis and body viz. clutch system, transmission system, final drive, front axle, steering mechanism.

COURSE OUTCOMES

On completion of this course, a learner should be able to:

CO1: Classify the vehicle
CO2: Identify major components of vehicles
CO3: Explain the function and working of clutch
CO4: Explain the function and working of transmission
CO5: Dismantle and assemble major assemblies of transmission
CO6: Describe the functional and constructional features of final drive and its components
CO7: Describe the functional and constructional features of front axles
CO8: Comprehend steering geometry and explain the working and constructional features of steering system
C09: Perform wheel alignment.

DETAILED CONTENTS

UNIT I

1. Chassis and Body

1.1 Definition and classification of automobile
1.2 Vehicle identification number (VIN)
1.3 Layout of chassis & function of its major assemblies
1.4 Types of drives - rear wheel drive, front wheel drive & 4-wheel drive; their merits and demerits
1.5 Chassis frame & its types, frame materials
1.6 Automobile body & its types, requirement of body, types of car body
1.7 Constructional details of car body, body streamlining, body materials

1.8 Interior fittings, instrument panel, car accessories, body upholstery
1.9 Materials for frame and body, protective coatings for body
1.10 Vehicle air-conditioning – working principle, system layout and its components

UNIT II

2. Clutch

2.1 Clutch - Function and Necessity; Requirements of a good clutch
2.2 Classification of clutch, working principle of friction clutch
2.3 Single plate clutch - construction and working, construction details of clutch plate
2.4 Multi plate clutch – construction and working
2.5 Semi-centrifugal clutch - construction and working
2.6 Centrifugal clutch - construction and working
2.7 Fluid flywheel - construction and working
2.8 Dual clutch system
2.9 Friction lining materials
2.10 Clutch operating system – mechanical, hydraulic and electromagnetic. Clutch pedal freeplay
2.11 Wet and dry clutch
2.12 Common faults, their causes & remedies in clutch.

UNIT III

3. Transmission

3.1 Introduction to transmission, its necessity and functions
3.2 Concept of gear drive – simple, compound and planetary; gear ratio
3.3 Classification of gear box.
3.4 Sliding mesh gear box - Construction and working.
3.5 Constant mesh gear box- Construction and working
3.6 Synchromesh gear box - Construction and working, principle, construction & working of synchronising unit
3.7 Gear selector mechanism,
3.8 Epicyclic gear box - Construction and working; over drive
3.9 Torque converter - Construction and working
3.10 Over running clutch – Necessity, construction and working, its applications
3.11 Transfer gear box - construction and working
3.12 Automated Manual Transmission
3.13 Continuously variable transmission
3.14 Dual Clutch Transmission

3.15 Intelligent Manual Transmission
3.16 Common faults in transmission, their causes and remedies.

UNIT IV

4. Final Drive

4.1 Universal joint – Function, types and constructional details, constant velocity joints
4.2 Propeller shaft – Function and constructional details, necessity of slip joint.
4.3 Differential – principle, functions, construction and working
4.4 Types of final drive – hotchkiss drive, torque tube drive.
4.5 Rear axles – semi floating, three quarter floating and fully floating, axle housing.

5. Front Axle

5.1 Types of front axles – Dead axle, live axle
5.2 Function and constructional details of front dead axle and front live axle
5.3 Types of Stub axle – Elliot and reverse Elliot, Lamoine and reversed Lamoine type

UNIT V

6. Steering system

6.1 Purpose and principle of steering
6.2 Definition of link and mechanism, steering system linkages
6.3 Ackermann's steering mechanism
6.4 Steering gear box – types, construction and working
6.5 Steering geometry – camber, castor, king pin inclination, toe-in, toe-out
6.6 Wheel alignment – Necessity and Procedure
6.7 Concepts of steering ratio, turning radius, cornering force, cornering power, self righting torque, over steering and under steering
6.8 Power steering – necessity & types, construction and working of Electrical power steering
6.9 Common faults, their causes and remedies in steering system.

PRACTICAL EXERCISES

1. Identification and sketching of major components in the layout of chassis of a scooter/motor cycle/3 wheeler
2. Identification and sketching of major components in layout of chassis of a car/jeep, truck/bus
3. Dismantling, inspection and reassembling of single plate clutch.

4. Dismantling, inspection and reassembling of multi plate clutch.
5. Servicing of clutch linkages, and clutch pedal freeplay adjustment.
6. Servicing of transmission system – gear box, universal joints, propeller shaft, slip joint, differential and axles.
7. Removal of gear box from vehicle and its refitting. Demo of gear shifting mechanism.
8. Servicing, dismantling and reassembling of synchromesh gear box.
9. Servicing of steering system and steering wheel freeplay adjustment.
10. Wheel alignment using computerised wheel alignment machine.
11. Study of electrical power steering system.
12. Servicing and trouble shooting of an automobile air conditioning system

Note: Safety precautions and cleanliness must be practised in each practical.

RECOMMENDED BOOKS

1. Dr. Kirpal Singh, "Automobile Engineering, Vol. I- II", Standard Publishers.
2. GBS Narang, "Automobile Engineering", Khanna Publishers, Delhi.
3. G. S. Aulakh, "Chassis, Body and Transmission-I", Eagle Prakashan, Jalandhar.
4. R.B. Gupta, "Automobile Engineering", Satya Prakashan, New Delhi.
5. Vijay Singh and R K Chauhan, "Chassis, Body and Transmission - I", Ishan Publications, Jalandhar.

INSTRUCTIONAL STRATEGY

Teacher should make use of audio visual aids to show features of chassis, body and transmission. Demonstration should be made in the automobile shop to explain various aspects of chassis, body and transmission. Charts should be prepared by the students showing specification of various 2-wheeler & 4-wheeler vehicle.

4.6 COMPUTER AIDED DRAFTING FOR AUTOMOBILE ENGINEERING

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RATIONALE

A diploma holder is expected to prepare and interpret CAD Drawings. Hence this subject.

COURSE OUTCOMES

On completion of this course, students will be able to:
CO1: Draw and interpret automobile parts using 2 D commands in CAD software.
CO2: Create easy and complex solids and assemblies using various tools in CAD software.

DETAILED CONTENTS

1. Introduction to Computer Aided Drafting (2D) commands of any one software (Auto CAD, ProE, Solid works, Solid Edge, Unigraphics NX etc.)

1.1 Concept of AutoCAD, Tool bars in CAD software, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar), setting of units and layout.

1.2 Drawing commands – point, line, arc, circle, ellipse

1.3 Editing commands – scale, erase, copy, stretch, lengthen and explode.

1.4 Dimensioning and placing text in drawing area

1.5 Sectioning and hatching

1.6 Inquiry for different parameters of drawing entity

1.7 Create layers within a drawing

1.8 Specifying Geometrical Dimensioning & tolerancing (GD&T) parameters in drawing

1.9 Plotting/printing drawings and creating template files

2. Detail and assembly drawing of the following using Drafting Software (2D) (6 sheets)

2.1 Ball Joint, tie rod

2.2 Screw jack

2.3 Crank shaft

2.4 Piston

2.5 Single plate clutch

2.6 Stepped pulley, V-belt pulley

3. Isometric Drawing by CAD using any part modeling Software (3D) (1 sheet)
Drawings of following on computer:
- Cone
- Cylinder
- Cube
- Isometric view of objects

4. Introduction to any part modeling software (ProE, Solid works, Solid Edge AutoCAD, Uni Graphic NX , Catia etc.)
Introduction to Sketcher: Sketch Entities, Sketch Tools, Blocks, Dimensioning

4.1 Part modeling (4 models)
Part Modeling Tools:-
4.1.1 Creating reference planes
4.1.2 Creating Extrude features Creating Revolve Creating Swept features
4.1.3 Creating Loft features
4.1.4 Creating Reference - points, axis, coordinates
4.1.5 Creating curves
4.1.6 Creating Fillet features
4.1.7 Inserting Hole types
4.1.8 Creating Chamfer
4.1.9 Creating Shell
4.1.10 Creating Rib
4.1.11 Environment & Utilities - Working with views and manipulating views.
4.1.12 Create parts e.g. Piston, Pin, Bolts and Nuts, Fixture, Jig parts, Washer, Rings, Gaskets, Machine parts etc.

4.2 Assembly Modeling:-
Introduction to Assembly Modeling & Approaches – Top down and Bottom up approach.

RECOMMENDED BOOKS

1. T. Jeyapooran, “Engineering Drawing with AutoCAD 2000”, Vikas Publishing House, Delhi.
2. P. Nageswara Rao, “AutoCAD for Engineering Drawing Made Easy”, Tata McGraw Hill, New Delhi.
3. P S Gill, “Auto CAD 3 D Modelling Fundamentals”, S K Kataria and Sons, New Delhi.

4. Ajit Singh, “Auto CAD 2000”, TMH, New Delhi.
5. Instruction Manual of the software used (AutoCAD, ProE, Solidworks, Solid Edge, Unigraphic NX etc.)

INSTRUCTIONAL STRATEGY

Teachers should show model or realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning, & layout of sheet. Teachers should ensure use of IS codes related to drawing.

4.7 MECHANICAL WORKSHOP PRACTICE-II

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RATIONALE

Diploma holders are responsible for supervising production processes especially CNC machines to achieve production targets. For this purpose, skills related to part programming and preparing jobs on CNC machines are required to be developed. Hence this subject.

COURSE OUTCOMES

On completion of this course, students will be able to:
CO1: Develop part program for lathe operations.
CO2: Develop part program for milling operations.

PRACTICAL EXERCISES

1. Identification of various parts and constructional detail of CNC lathe.
2. Identification of various parts and constructional detail of CNC milling machine.
3. Preparation of work instructions for machine operator and safety precautions during operations on CNC machines.
4. Develop a part program for following lathe operations and make the job on CNC lathe.
   - Plain turning and facing operation
   - Taper turning operation
   - Circular interpolation.
5. Develop a part program for the following milling operations and make the job on CNC milling
   - Plain milling
   - Slot milling
   - Contouring
   - Pocket milling
6. Preparation of preventive maintenance schedule for CNC machine.
7. Demonstration on Electro discharge machine (EDM).
8. Demonstration of robotic welding machine.

Note: Demonstration of advanced machining methods may be done through industrial visits.

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THIRD YEAR

NSQF LEVEL - 5

18. STUDY AND EVALUATION SCHEME

FIFTH SEMESTER :

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
5.1	Industrial Training-II	-	2	0+1=1	-	40	40	-	60	60	100
5.2	Auto Engine - II	3	2	3+1=4	40	40	80	60	60	120	200
5.3	Chassis, Body and Transmission - II	3	2	3+1=4	40	40	80	60	60	120	200
5.4	Multidisciplinary Elective (MOOCs/Offline)	2	-	2+0=2	40	-	40	60	-	60	100
5.5	Programme Elective-I	3	-	3+0=3	40	-	40	60	-	60	100
5.6	Auto Professional and Driving Practice - I	-	10	0+5=5	-	40	40	-	60	60	100
5.7	Minor Project	-	8	0+4=4	-	40	40	-	60	60	100
# Student Centered Activities(SCA)		-	-	-	-	-	-	-	-	-	-
	Total	**11**	**24**	**23**	**160**	**200**	**360**	**240**	**300**	**540**	**900**

Programme Elective-I: **5.5.1.** Auto Electrical Systems and Electric Vehicles **5.5.2.** Auto Body Fabrication and Repair

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

SIXTH SEMESTER :

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
6.1	MVA and Garage Management	3	-	3+0=3	40	-	40	60	-	60	100
6.2	Auto Professional and Driving Practice - II	-	10	0+5=5	-	40	40	-	60	60	100
6.3	*Entrepreneurship Development & Management	3	-	3+0=3	40	-	40	60	-	60	100
6.4	Programme Elective II	3	-	3+0=3	40	-	40	60	-	60	100
6.5	Major Project/Industrial Training	-	12	0+6=6	-	40	40	-	60	60	100
# Student Centered Activities(SCA)		-	4	-	-	-	-	-	-	-	-
	Total	**9**	**26**	**20**	**120**	**80**	**200**	**180**	**120**	**300**	**500**

* Common with other Diploma Courses

Programme Elective II: 6.4.1. Tractor and Special Purpose Vehicles **6.4.2.** Production Engineering

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

19. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects/Areas	Hours Per Week	
		Fifth Semester	Sixth Semester
1.	Industrial Training-II	2	-
2.	Auto Engine - II	5	-
3.	Chassis, Body and Transmission - II	5	-
4.	Multidisciplinary Elective (MOOCs/Offline)	2	-
5.	Programme Elective-I	3	-
6.	Auto Professional and Driving Practice - I	10	-
7.	Minor Project	8	-
8.	MVA and Garage Management	-	3
9.	Auto Professional and Driving Practice - II	-	10
10.	Entrepreneurship Development & Management	-	3
11.	Programme Elective II	-	3
12.	Major Project/Industrial Training	-	12
13.	Student Centred Activities	-	4
	Total	35	35

20. COMPETENCY PROFILE AND EMPLOYMENT OPPORTUNITIES

Government and private sectors related to **Automobile Engineering** require **supervisors and technician engineers,** having well developed skills with clear choice of procedures. They are expected to have complete knowledge and practical skills related to automobile engineering. They shall be able to communicate clearly with others. Diploma holders after passing level 5 shall have understanding of desired mathematical skills and understanding of social and natural environment. They are expected to collect, organize and communicate information effectively.

Work requiring knowledge, skills and aptitudes at level 5 will also be carried out in familiar situations, but also ones where problems may arise. Job holders will be able to make choices about the best procedures to adopt to address problems where the choices are clear. Individuals in jobs which require level 5 qualifications will normally be responsible for the completion of their own work and expected to learn and improve their performance on the job. They will require well developed practical and cognitive skills to complete their work. They may also have some responsibility for others' work and learning.

Individuals employed to carry out these jobs will be expected to be able to communicate clearly in speech and writing and may be required to apply mathematical processes. They should also be able to collect and organise information to communicate about the work. They will solve problems by selecting and applying methods, tools, materials and information. They will be expected to have previous knowledge and skills in the occupation, and to know and apply facts, principles, processes and general concepts in the occupation. They will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their work. They will be expected to operate hygienically and in ways which show an understanding of environmental issues. They will take account of health and safety issues as they affect the work they carry out or supervise. In working with others, they will be expected to conduct themselves in ways which show an understanding of the social and political environment.

They are expected have the knowledge of Auto Engines, Chassis Body and Transmission, Auto Electrical Systems, Electric Vehicles, Production Engineering, MVA and Garage Management, Tractor and Special Purpose Vehicles and Auto Body Fabrication and Repair practices being followed in the automobile engineering. They might find work with a manufacturing company and spend time maintaining, or even designing, the machines that perform much of the automations.

They might also work in relevant laboratories for any institute, university or even a private companies. They are expected to have good exposure of humanities, life skills, entrepreneur development and mangement to establish small start-ups in the area of Marketing, Sales, Repair and Maintenance etc**.**

They have wide scope to work as supervisory technical employee on wage basis in following organizations: In manufacturing industries primarily in private sector and to some extent in public sector such as: Automobile and auto ancillary industry, Ordinance factory, DRDO, National Automotive Testing & R&D Infrastructure Project (NATRIP) and similar organizations, State transport authorities, Garages of municipal corporations and other public/private sector undertakings, Maintenance department of heavy earth moving equipment, Repair and maintenance of Tractor and Agriculture equipment in service center, Military Engineering Service, Motor Vehicle Authority, Pollution Level Testing, Driving Test, Surveyor in Insurance Companies. Instructor in Technical Institutions

They have wide scope in establishing small start-ups in the area of Marketing and Sales, Manufacturing Units and Repair and Maintenance units, Garages/Service Stations/Annual Maintenance Contractors etc.

21. PROGRAMME OUTCOMES

The programme outcomes are derived from five domains of NSQF Level – 5 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this level, the student will be able to:

PO1: Perform task that require well developed skills with clear choice of procedures.

PO2: Acquire knowledge of facts, principles and processes related to Automobile Engineering.

PO3: Demonstrate cognitive and practical skills to complete tasks and solve problems.

PO4: Develop skills to collect, organize and communicate information.

PO5: Accomplish own work and supervise others work.

PO6: Select online multidisciplinary electives of own interest to promote self-learning.

22. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be assessed	Assessment criteria for the Course Outcomes
PO1: Perform task that require well developed skills with clear choice of procedures.	• Explain the working environment of industries • Take necessary safety precautions and measures. • Demonstrate competencies and skills required by relevant industries. • Identify various road signs, signals and rules
PO2: Acquire knowledge of facts, principles and processes related to automobile engineering	• Explain the phenomenon of combustion in I.C. Engines. • Identify and select various components of fuel supply system in diesel engine. • Describe the effects of automobile pollution on humans, measure pollution and methods to control pollution. • Explain the concepts involved in hybrid and electric vehicle. • Explain the concepts involved in specialized engines like Wankel, OPOC, HCCI engines. • Explain the functions, constructional features and working of various types of brakes • Explain the constructional detail and features of wheels and tyres. • Describe the function of various automotive safety systems. • Describe the charging and starting systems of automotive. • Explain features of electrical and electronics components in modern vehicles. • Explain working of electrically driven vehicles. • Describe assembly line system • Explain various check-ups before, during and after driving a vehicle • Study the service manuals of vehicles • Explain salient features of the Motor Vehicle Act

	• Outline the various types of vehicle insurances and their claim settlement procedure • Describe fundamentals of transport management • Classify the tractors and describe their applications • Explain the working of chassis components and supplementary systems of tractor • Explain the functions of hydraulic system of tractor • Write specifications of wheels and tyres of tractor • Elucidate comfort and safety issues of operator of tractor • Identify maintenance checks and common faults in tractors • Describe the working principles of earth moving machinery like loader, cranes, excavator, forklift truck dumper etc. • Describe the vehicle body design fundamentals • Explain the various auto-body fabrication processes • Enumerate the applications of body repair tools • Elucidate the various body repair methods • Explain the auto-body painting procedure
PO3: Demonstrate cognitive and practical skills to complete tasks and solve problems.	• Diagnose various engine faults and rectify the same. • Test Fuel injectors and Fuel Injection Pump • Diagnose and rectify faults in automobile suspension system • Execute wheel balancing using computerized wheel balancing machine. • Diagnose and rectify the faults and servicing of in braking system. • Identify the functions of various electrical components of an automobile • Illustrate the working, charging and defects of battery

	• Demonstrate various lighting circuits, wiring diagrams and accessories • Measure productivity • Apply the principles of costing in product costing • Apply the principle and techniques in production planning and control of a production system • Ensure quality by using different levels of inspection techniques of various stages of Production • Gain diving proficiency on driving simulator and actual vehicles • Test electrical components such as battery, alternator, dynamometer etc. • Test engine, ignition timing, valve timing and spark plug gap and set them • Remove, service and refit chassis components, engine parts and Replace drive axles • Manage an automobile garage • Use the special garage tools • Drive four wheeled passenger vehicle independently and under abnormal weather conditions • Inspect a vehicle thoroughly for damage and insurance claims. • Diagnose the engine problems, remove and refit the engine in a vehicle • Overhaul petrol and diesel engines • Overhaul various chassis and transmission components
PO4: Develop skills to collect, organize and communicate information.	• Demonstrate writing, speaking and presentations skills. • Use different marketing and sales techniques • Define the problem statement of the minor project according to the need of industry. • Write the minor project report effectively. • Present the minor project report using PPT. • Presentation Skills development. • Write the major project/industrial training report effectively.

	• Present the major project/industrial training project report using PPT.
PO5: Accomplish own work and supervise others work.	• Work in team for solving industrial problems • Work as a team member for successful completion of minor project. • Explain the importance of entrepreneurship and its role in nation's development. • Classify the various types of business and business organizations. • Identify the various resources / sources and / or schemes for starting a new venture. • Explain the principles of management including its functions in an organisation. • Conduct market survey and prepare project report. • Work as a team member for successful completion of Industrial training / Major project.
PO6: Select online open elective of own interest to promote self-learning.	• Describe present and future requirement of industries. • Apply critical thinking problem solving. • Demonstrate self and time management. • Display analytical and research abilities. • Integrate multiple knowledge domains. • Enhance the scope and depth of learning. • Define the problem statement of the Industrial training / Major project according to the need of industry.

23. SUBJECTS & CONTENTS

(THIRD YEAR)

FIFTH SEMESTER

5.1	Industrial Training-II	152-153
5.2	Auto Engine - II	154-157
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5.4	Multidisciplinary Elective (MOOCs/Offline)	162-163
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5.1 INDUSTRIAL TRAINING-II

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-	2

RATIONALE

Industrial training will help the students to understand the working environmentof relevant industries. The student will learn to work in team to solve the industrial problems. It willalso give exposure about the present and future requirements of the relevant industries. This trainingis very important for development of required competencies and skills for employment and start– ups.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1: Explain the working environment of industries
CO2: Take necessary safety precautions and measures.
CO3: Describe present and future requirement of industries.
CO4: Work in team for solving industrial problems
CO5: Demonstrate competencies and skills required by relevant industries.
CO6: Demonstrate writing, speaking and presentations skills.

PRACTICAL EXERCISES

1. Report writing based on industrial training.
2. Preparation of Power Point Slides based on industrial training and presentation by the candidate.
3. Internal Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.
4. External Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.

GUIDELINES

Students will be evaluated based on Industrial training report and their presentation using Power Point about the knowledge and skills gained during the training. The Headof the Department will depute faculty coordinators by assigning a group of students to each. The coordinators will mentor and guide the students in preparing the PPTs for final presentation. The following performance parameters are to be considered for assessment of the students out of 100 marks:

	Parameter	**Weightage**
i	Industrial assessment of the candidate by the trainer	40%
ii	Report Writing	20%
iii	Power Point Presentation	20%
iv	Viva-voce	20%

5.2 AUTO ENGINE – II

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RATIONALE

Engine forms the base of an Automobile. As the scope of auto engines is very wide. The subject covers the details of diesel engines and other types of auto engines. It also includes combustion and troubleshooting of I.C engine. Brief description of engines of modern vehicles has also been included in this subject.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1 Explain the phenomenon of combustion in I.C. Engines.
CO2 Identify and select various components of fuel supply system in diesel engine.
CO3 Diagnose various engine faults and rectify the same.
CO4 Describe the effects of automobile pollution on humans, measure pollution and methods to control pollution.
CO5 Explain the concepts involved in hybrid and electric vehicle.
CO6 Explain the concepts involved in specialized engines like Wankel, OPOC, HCCI engines.
CO8 Test Fuel injectors and Fuel Injection Pump

DETAILED CONTENTS

UNIT I

Combustion in S.I. Engines

Phenomenon of combustion in S.I. engine: phases of combustion – Ignition lag, flame propagation and after burning; Turbulence; Abnormal combustion; Pre-ignition and Detonation; Octane rating

Combustion in C.I. Engines

Phenomenon of combustion in C.I. engines: phases of combustion – Ignition delay, uncontrolled combustion, controlled combustion, after burning; Methods of producing air movements namely squish and swirl; Various types of combustion chambers for diesel engine; Diesel knock; cetane rating.

UNIT II

Fuel Supply System in Diesel Engine

Layout of fuel supply system in diesel engine and their types; Modern common rail direct injection (CRDI) system and individual pump system; Fuel filters – primary and secondary; Fuel feed pumps; priming; Fuel injection pumps – plunger and barrel type, distributor type; Fuel injectors and their working; Governing and types of governors.

Supercharging of engines – function; advantages and disadvantages; types and location of superchargers; Turbochargers – types, function, working and advantages.

UNIT III

Specialized Types of Engine

Wankel engine; Opposed piston opposed cylinder (OPOC) engine; Fuel cell engine/hydrogen engine; Homogeneous Charge Compression Ignition (HCCI) engine; Camless engine; CNG/LPG engine.

Electric and bio fuel vehicle

Electrical / hybrid system/plug-in hybrid system fundamentals; Electric vehicle battery thermal management system; Electric wheel motor; Alternative automotive fuels (bio fuels) - fundamentals and future.

UNIT IV

Engine faults and their rectifications

Causes and rectification of: High oil (engine oil) consumption, High fuel (petrol/diesel) consumption, Engine starting troubles, Engine overheating, Engine misfiring.

UNIT V

Emission Control

Exhaust pollutants from petrol and diesel engines and their effects on human beings and other materials; Sources of automotive emission.

Methods of emission control: improvement in engine design, exhaust gas treatment, positive crankcase ventilation, and exhaust gas recirculation; catalytic converters for petrol and diesel engines; particulate filter; selective catalytic reduction technique; NO_X absorbers; Diesel Exhaust Fluid technology to reduce emission ; Emission norms (Bharat Stage (I-VI),

Miscellaneous Topics

Specifications of naturally aspirated and turbo charged IC Engines; Technologies to improve engine economy and output, Electro-mechanical components – fuel pump, oil pump.

PRACTICAL EXERCISES

1. Study & servicing of fuel feed system of diesel engine – replacing fuel filter, inspection of fuel feed pump according to service manual of any Indian Car Company.
2. Study & sketching of common rail direct injection (CRDI) fuel system.
3. Phasing and calibration of fuel injection pump.
4. Cleaning and testing fuel injectors used in petrol and diesel engines.
5. Servicing /replacing of air cleaner – wet type and dry type for an Indian car.
6. Study of turbochargers
7. Analysis of exhaust gases of diesel engine using smokemeter/exhaust gas analyser (following norm/or not) by Bharat Stage (I-VI) table.
8. Analysis of exhaust gases of petrol engine using exhaust gas analyser (following norm or not) by Bharat Stage (I-VI) table.

Note: Safety precautions and cleanliness must be practised in each practical.

RECOMMENDED BOOKS

1. R.B. Gupta, “Automobile Engineering”, Satya Prakashan, New Delhi.
2. Dr. Kirpal Singh, “Automobile Engineering – Vol. I and II”, Standard Publishers Distributors, Delhi.
3. Even Shekhri, “Auto Engine II”, Ishan Publications, Jalandhar.
4. KM Gupta, “Automobile Engineering”, Umesh Publishers, Delhi
5. Srinivasan, “Automotive Engines”, TMH, Delhi
6. Chikara, “Automobile Engineering”, Dhanpat Rai and Sons, New Delhi.
7. G.S. Aulakh, “Auto Engine –II”, Eagle Prakashan, Jalandhar.
8. G.S. Sethi, “Automobiles- Theory and Assignment Test (Solved)”, Asian Publishers, New Delhi.

RECOMMENDED WEBSITES

1. https://www.howacarworks.com/basics/the-engine
2. https://www.sciencedirect.com/topics/engineering/automotive-engine
3. https://www.acko.com/car-guide/car-engine/
4. https://swayam.gov.in/

INSTRUCTIONAL STRATEGY

This subject contains five units of equal weightage. This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills among the students. Teaches should take the students to industry and explain the details of various systems and

their components. While imparting instructions, focus should be on conceptual understanding. During practice work, it should be ensured that students get opportunity to individually perform practical tasks. Teachers should invite experts from the industries, research and higher level organizations/institutions to engage some sessions on the latest developments taking place on the subject. The teacher should lay emphasis in making the students conversant with the principles and practices related to various types of engines. Audio visual aids should be used to show engine features and working. Demonstrations should be made in automobile shop to explain various engine components. Some industrial and field visit may also be arranged.

5.3 CHASSIS, BODY AND TRANSMISSION-II

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RATIONALE

Chassis, body and transmission form the core of automobiles. The subject aims at imparting knowledge and skills regarding chassis and body viz. suspension system, wheel and tyre, braking system and safety of vehicles. Students shall also be exposed to braking systemes and important safety features of automobiles.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1 Explain functions and constructional features of various types of automotive suspension system
CO2 Diagnose and rectify faults in automobile suspension system
CO3 Explain the functions, constructional features and working of various types of brakes
CO4 Explain the constructional detail and features of wheels and tyres.
CO5 Execute wheel balancing using computerized wheel balancing machine.
CO6 Diagnose and rectify the faults and servicing of in braking system.
CO7 Describe the function of various automotive safety systems.

DETAILED CONTENTS

UNIT I

1. Suspension System

1.1 Functions of suspension system,
1.2 Definition of sprung weight, unsprung weight, spring rate, brake dip
1.3 Types of suspension springs – coil spring, leaf spring, torsion bar, air spring
1.4 Constructional details of semi-elliptical leaf spring suspension
1.5 Function and construction of variable rate spring and helper spring
1.6 Spring materials and their characteristics
1.7 Function of shock absorber, Principle, construction and working of telescopic shock absorber, concept of gas filled shock absorber.

1.8 Types of suspension systems – Rigid axle & Independent suspension system
1.9 Independent suspension system – types and advantages.
1.10 Stabilizer bar and its function
1.11 Pneumatic suspension system
1.12 Concept of Active Suspension System
1.13 Diagnosis of common faults and their rectifications

UNIT II

2. Wheels and Tyres

2.1 Introduction to wheel assembly
2.2 Definition of wheel base, wheel track, ground clearance
2.3 Wheels – function, requirement and types
2.4 Constructional details of various types of wheels; wheel materials
2.5 Wheel specification
2.6 Tyre – purpose & classification of tyres
2.7 Constructional details of tubed tyre and tubeless tyre & their comparison
2.8 Types of carcass – Cross ply, Radial ply and Mixed ply; Comparison of cross- ply and radial-ply tyres
2.9 Tyre materials, tyre dimension & specification,
2.10 Inflation pressure; under – inflation, over – inflation & their effects
2.11 Factors affecting excessive tyre wear
2.12 Concept of balancing; Wheel balancing - Static and dynamic.

UNIT III

3. Braking System - I

3.1 Purpose of Brakes; Principle of braking; stopping time & stopping distance
3.2 Requirements of good braking system
3.3 Classification of brakes
3.4 Drum brakes - Construction & working, leading & trailing shoes
3.5 Disc brakes – Construction & working
3.6 Materials of brake shoe, brake drum, brake pad & brake lining
3.7 Mechanical braking system – Layout & working
3.8 Hydraulic brakes – Principle, layout & working; Constructional details of master cylinder, wheel cylinder and Tandem master cylinder
3.9 Brake fluid – specification and characteristics
3.10 Bleeding of brakes

3.11 Hand brake or parking brake – Purpose, layout & working

UNIT IV

4. Braking System - II

4.1 Power brakes – definition, requirement & classification

4.2 Vacuum Brakes – Principle, layout & working

4.3 Air Brakes – layout, components & working

4.4 Air Hydraulic brakes – Layout, components & working

4.5 Brake tests

4.6 Common braking system faults, their causes & rectification

UNIT V

5. Automotive Safety

5.1 Meaning of automotive safety,

5.2 Active safety systems - Preventive design, Introduction to: Antilock Brake System (ABS), Electronic brake force distribution (EBD), Electronic vehicle stability (EVS), Braking Assist (BA), Traction Control System (TCS), Hill Assist (HA), Smart cruise control, Pedestrian protection system, Rear detection system & Night vision system

5.3 Passive safety systems – Design of vehicle for minimum injury, Seat belt & Air bag, Pre-requisites for air bag deployment.

5.4 Crash test for safety.

PRACTICAL EXERCISES

1. Study and sketching of independent suspension system.
2. Checking and servicing of telescopic shock absorber.
3. Removal, dismantling, servicing, assembling and refitting of leaf spring assembly.
4. Wheel balancing using computerised wheel balancing machine and tyre rotation.
5. Replacement of brake shoe & brake pad.
6. Servicing of mechanical brakes, adjustment of brake pedal freeplay.
7. Servicing and repair of hydraulic brake system, bleeding of brakes.
8. Study of mechanical hand brake system and required adjustments.
9. Visit to local motor market to learn wheel alignment and balancing.
10. Study of various safety systems i.e. seat belt, air bag etc. of a vehicle.

Note: Safety, precautions and cleanliness must be practised in each practical.

RECOMMENDED BOOKS

1. Automobile Engineering by R.B. Gupta, Satya Prakashan, New Delhi.
2. Automobile Engineering, Vol. I – II by Dr. Kirpal Singh, Standard Publishers, Delhi
3. A to Z of Automobile Engineering by Dr. Kirpal Singh, Standard Publishers, Delhi
4. Chassis, Body and Transmission by Vijay Singh & Raj Kumar, Ishan Publications, Jalandhar.
5. Automobile Engineering by GBS Narang, Khanna Publishers, Delhi
6. Chassis, Body and Transmission-II by G.S.Aulakh, Eagle Prakashan, Jalandhar.
7. Automobiles - Theory and Assignment/Test (Solved) by G.S.Sethi, Asian Publishers, New Delhi.
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

1. https://autoinfome.blogspot.com/p/automobile-chassis-frame-and-body.html
2. https://wuling.id/en/blog/autotips/car-chassis-101-the-functions-types-and-components
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This subject contains five units of equal weightage. This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills among the students. Teaches should take the students to industry and explain the details of various systems and their components. While imparting instructions, focus should be on conceptual understanding. During practice work, it should be ensured that students get opportunity to individually perform practical tasks. Teachers should invite experts from the industries, research and higher level organizations/institutions to engage some sessions on the latest developments taking place on the subject. Some industrial and field visit may also be arranged. Teacher should make use of audio visual aids to show features of chassis, body and transmission. Demonstration should be made in the automobile shop to explain various aspects of chassis, body and transmission.

5.4 MULTIDISCIPLINARY ELECTIVE

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RATIONALE

Multidisciplinary electives are very important and play major role in implementation of National Education Policy. Multidisciplinary is a subject which is useful for two or more disciplines in which students are asked to understand the concept of multidisciplinary or interdisciplinary. It will help the students to gain an arsenal of skills that are easily transferable across work environments.

COURSE OUTCOMES

At the end of the open elective, the students will be able to:

CO1: Apply critical thinking problem solving.
CO2: Demonstrate self and time management.
CO3: Display analytical and research abilities.
CO4: Integrate multiple knowledge domains.
CO5: Enhance the scope and depth of learning.

LIST OF MULTIDISCIPLINARY ELECTIVES

(The list is indicative and not exhaustive)

1. Introduction to Internet of Things
2. Introduction to Robotics
3. Introduction to Embedded System Design
4. Fundamentals of Artificial Intelligence
5. Digital Image Processing
6. Introduction to Machine Learning
7. Fundamentals of Artificial Intelligence
8. The Joy of Computing Using Python

9. Cloud Computing
10. Introduction to Industry 4.0
11. Industrial Internet of Things
12. Object Oriented System Development using UML, Java and Patterns

GUIDELINES

Multidisciplinary Elective shall be offered preferably in online mode. Online mode multidisciplinary elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, Khan Academy or any other online portal to promote self-learning. A flexible basket of large number of multidisciplinary electives is suggested which can be modified depending upon the availability of courses at suggested portals and requirements. For online multidisciplinary electives, department coordinators shall be assigned to monitor and guide the group of students for selection of minimum 20 hours duration online course of their choice. For offline multidisciplinary electives, a suitable relevant subject shall be offered by the respective department to the students with minimum 40% of the total class strength as per present and future requirements.

Assessment of MOOCs multidisciplinary elective shall be based on continuous evaluation by the respective coordinator. The coordinator shall consider the submitted assignments by the students from time to time during the conduct of MOOCs. The MOOCs assessment shall be conducted by the coordinator along with one external expert by considering submitted assignments out of 100 marks.

In case, no suitable multidisciplinary elective is available online, only then the course may be conducted in offlinemode. The assessment of offline multidisciplinary elective shall be internal and external. The offlinemultidisciplinary elective internal assessment of 40 marks shall be based on internal sessional tests, assignments etc. and external assessment of 60 marks shall be based on external examination at institute level.

RECOMMENDED WEBSITES

1. https://swayam.gov.in/
2. https://www.udemy.com/
3. https://www.upgrad.com/
4. https://www.khanacademy.org/

5.5 PROGRAMME ELECTIVE-I
5.5.1 AUTO ELECTRICAL SYSTEMS & ELECTRICAL VEHICLES

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RATIONALE

Diploma holders in automobile engineering have to deal with different types of batteries, their charging and testing, regulators, lighting system and various other electrical accessories used in Automobile Engineering. Also, electrical vehicles technology is growing fast, so the students of diploma should also be exposed to technology of electrically driven vehicles

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1 Identify the functions of various electrical components of an automobile
CO2 Illustrate the working, charging and defects of battery
CO3 Describe the charging and starting systems of automotive.
CO4 Demonstrate various lighting circuits, wiring diagrams & accessories
CO5 Explain features of electrical and electronics components in modern vehicles.
CO6 Explain working of electrically driven vehicles.

DETAILED CONTENTS

UNIT-I

Introduction

Various Electrical and Electronics equipment components/systems in automobile, their functions and requirements; earth return system; types of earthing; 6V, 12V and 48 V systems

Batteries

Lead Acid Batteries: Construction, working, elements, materials used; electrolyte and its strength; effect of added plate area and temperature; battery rating; battery capacity; battery efficiency; temperature characteristics; terminal voltages; charging and discharging.

Battery Testing: Electrolyte testing by hydrometer, voltage test, high rate discharge and cadmium test.
Battery Charging: Constant potential and constant current, initial charging, normal charging, trickle charging, intermittent charging, boost charging.
Battery Defects: Sulphation, plates decay, erosion, cracking, sedimentation, separator defects, short circuits, overcharging failure.
Alkaline Batteries: Basic description, types, merits and demerits.
Concept of less maintenance and maintenance-free batteries

UNIT-II

Charging System

Charging circuits, function and various components; dynamo and alternator - types, construction, working, advantages and disadvantages of dynamo and alternators; cut out relay.
Regulation: Need of regulation; working of regulators for dynamo and alternator.

Starting System

Function of various components; torque terms; principle and constructional details of starter motor; types of switches; starter to engine drive and their types - bendix drive & overrunning clutch, integrated starter generator (ISG).

UNIT-III

Lighting System

Various lighting circuits; head lamp - types and constructional details of sealed beam, double filament head lamps; Various types of lights - fog light, side light, brake light, instrument light, indicator lights, reversing light, warning light, interior lights, LED lights, day time running lights(DRL).
Wiring: HT and LT, their specifications; cable colour codes; wiring Harness; Wiring diagrams of car and two-wheeler .

UNIT-IV

Electrical & Electronics Accessories

Working and functions of:-
Speedometer - digital and analog; tachometer; front and rear wind screen wipers and washers; defogger and defroster; electric door locks; key less entry; electric adjustable & foldable ORVM; parking sensor; follow me home headlamps; rain sensor; cruise control.

Electronic Control Devices

Familiarization with automobile electronic devices; working and applications of ECU, Sensoring units, Rectifiers, Analog and digital devices, immobilizer, microprocessor and microcontroller; Concept of advance driver assistant systems (ADAS) and their levels; concept of regenerative braking system

UNIT-V

Electric Vehicles

Introduction to electric vehicle; Government policies for E-vehicles; types of EV- pure electrical, hybrid, plug-in hybrid; working principle of EV, motor controller; working of electric motor to wheel transmission system and its components; various drive modes in EV; types of batteries used in EV's: Lithium ion battery & Nickel Metal Hydride battery – their construction and working; Fuel cells - Principle of working and types of fuel cell; Charging station layout.

RECOMMENDED BOOKS

1. Automobile Engineering by Dr. Kirpal Singh, Standard Publishers, Delhi
2. A to Z of Automobile Engineering by Dr. Kirpal Singh, Standard Publishers Distributors, Delhi
3. Automotive Electrical & Electronics Systems by Raj Kumar Chauhan, Ishan Publications, Jalandhar.
4. Automotive Electrical Equipment by P.L. Kohli, Tata McGraw Hill, Delhi
5. Automotive Electrical Equipment by William H. Crouse, Tata McGraw Hill, Delhi
6. Automobile Engineering by Dr. R.B. Gupta, Satya Prakashan, New Delhi
7. E-books/e-tools/relevant software as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

1. https://technosofteng.com/automotive-electrical-systems/
2. https://www.firestonecompleteautocare.com/blog/batteries/your-cars-electrical-system/
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This subject contains five units of equal weightage. While imparting instructions, focus should be on conceptual understanding. Training slides and videos should be used to supplement the classroom teaching. Teachers should invite experts from the industries, research and higher level organizations/institutions to engage some sessions on the latest developments taking place on the subject. Some industrial and field visit may also be arranged.

5.5.2 AUTO BODY FABRICATION AND REPAIR

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RATIONALE

Automobile body fabrication and repair is a very distinctive subject to learn for diploma holders in automobile engineering, as auto body minor or major damage are very common and their repair is in high demand. This subject may be beneficial for those students who want to choose this field as their profession. This subject provides knowledge and relevant skills about the fabrication of new auto body, body repair shop tools and equipment, as well as body repair and painting techniques.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1	Describe the vehicle body design fundamentals
CO2	Explain the various auto-body fabrication processes
CO3	Enumerate the applications of body repair tools
CO4	Elucidate the various body repair methods
CO5	Explain the auto-body painting procedure

DETAILED CONTENTS

UNIT I

Vehicle body Basics

Introduction to chassis, frame and body; Basic body construction & its classification; Integral body construction; car body sub-assemblies.

Factors considered for Safe body design like: safety body cell & crumple zone, driver's seat, window glasses, windshield, bumpers, space & safety in vehicle; Aerodynamic forces: lift, drag, and side forces; body streamlining.

Auto Body materials

Requirement of Auto body materials, different materials used and their relevant characteristics; development of new body materials; Selection of material.

UNIT– II

Automotive Metal Fabrication

Introductory concept of different metal fabrication processes: Automotive Metal Casting, Automotive Metal Cutting, Automotive Metal Folding, Automotive Metal Extrusion, Automotive Metal Stamping, Automotive Metal Welding, Automotive Metal Machining, Press fitting Techniques, Tube and Pipe Bending with Ring Roller, Plate Bending with Plate Roller, Fastening Techniques.

UNIT III

Body Repair Tools and Shop Equipment

Applications of Different Types of Hand Tools:

Marking material-chalk, Prussian blue;

Cleaning tools-Scraper, wire brush, Emery paper;

Measuring Tools - Calipers-inside and outside, Micrometer, steel rule, measuring tape, try square, Dividers, surface gauges, scriber;

Punches-prick punch, center punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut;

Hammers - ball pien and finishing hammer, planishing hammer, shrinking hammer, mallet, pick hammers, Bumping hammers;

Dollies – Double ended hand dolly, utility dolly, general purpose dolly, heel dolly, toe dolly, shrinking dolly;

Body spoons – pry spoon, general purpose spoon, dolly spoon, high crown spoon, spring hammering spoon, drip moulding spoon;

Other body tools – body picks, body pullers and pull rods, suction cup, scratch awl;

Metal cutting shears- Tin snips, sheet metal cutting pliers,(Aviation snips), panel cutters,

Trim and upholstery tools, Door handle tool (clip pullers);

Metal files-reveal file, surform file, sanding board, sanding block, spreaders;

Power Tools and their application

Pneumatic drill, Pneumatic wrench, blaster, drilling machine, body jack,

UNIT IV

Vehicle Body Repairs Techniques

Definition of dent, scratch; Types of scratch – minor, deep; Types of dent – round, sharp, crease, dings; Purposes of vehicle body repair; Ways to repair dent – paintless dent repair (PDR), Auto body shop repair;

Dent Repair methods – Suction pulling method, dolly & hammer method, heat and cold method, glue pulling, body jack pulling, panel replacement, Panel filling with plastic body and filler-forming with solder, Panel shrinking, Repairing of rusted body panels. Fiberglass repairs & replacement, Body aligning; Introduction to Collision repair system (CRS)

Interior trim and upholstery, Glass and door service, Exterior trim, Body insulation and sealing.

UNIT V

Vehicle Body Painting

Purpose of body paining;

Tools & Equipment required for painting – air compressor, air sander, grinder, block sander, scrapers, brushes, spray gun.

Body fillers - plastic fillers, fibreglass fillers;

Body abrasives – sand papers (wet and dry), Sanding disc**;**

Body primers, sealers and undercoats;

Types of paints – Enamel paint, urethane and lacquers;

Painting Procedure – Preparation, primer & sealer application, undercoat/base coat application, clear coat application, sanding & buffing, inspection: types of paint defects.

RECOMMENDED BOOKS

1. Kohli P. L, "Automotive Chassis & Body", Papyrus Publishing House, New Delhi.
2. Automobile Engineering Vol. I by Dr. Kirpal Singh, Standard Publishers, Distributors, Delhi
3. Automotive Bodywork and Rust Repair by Matt Joseph, Car Tech Publisher, Minnesota, USA.
4. Repair of Vehicle Bodies by Alan Robinson & Andrew Livesey, Butterworth–Heinemann Publishing House, Oxford, UK.
5. Automobile Engineering Vol-4: Body Repair and Painting by Chhikara A, Satya Prakashan-New Delhi.
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This subject contains five units of equal weightage. While imparting instructions, focus should be on conceptual understanding. Training slides and videos should be used to supplement the classroom teaching. Teachers should invite experts from the industries, research and higher level organizations/institutions to engage some sessions on the latest developments taking place on the subject. Some industrial and field visit may also be arranged. The students may be taken to workshops dealing in repair of tractors and heavy earth moving machinery and given practical demonstration.

5.6. AUTO PROFESSIONAL AND DRIVING PRACTICE-I

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RATIONALE

This subject is required to inculcate the professional skills in the students by performing various repairs, maintenance and testing jobs on automobile systems. After acquiring the theoretical knowledge, it becomes important to apply these theoretical concepts and principles in practical field in order to gain the required skills also. Driving skills are essential requirement for an automobile engineer. In this subject, the students will learn about driving and skills related to inspection, testing and repair of various engine, chassis and body assemblies in an automobile.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1 Identify various road signs, signals and rules
CO2 Gain diving proficiency on driving simulator and actual vehicles
CO3 Explain various check-ups before, during and after driving a vehicle
CO5 Study the service manuals of vehicles
CO6 Test electrical components such as battery, alternator, dynamometer etc.
CO7 Test engine, ignition timing, valve timing and spark plug gap and set them
CO8 Remove, service and refit chassis components, engine parts and Replace drive axles

PRACTICAL EXERCISES

UNIT-I

- Knowledge of general road safety and personal safety.
- Knowledge of Traffic rules, road signs and signals.
- Knowledge of penal traffic offences
- Study of owner's manual of a vehicle.
- Introducing the driving simulator & describe its features, such as steering wheel, pedals, dashboard display and screen.
- Driving practice on simulator
- Identification of various controls of vehicle.

- Pre- Driving Daily inspection like engine oil, brake oil, coolant, tyre Pressure, light, horn, and any leakage.
- Starting the engine and warming up.
- Operation of engaging and disengaging the clutch; Gear changing from low to high and high to low.
- Braking and use of brakes on the road, stopping distance and following distance.
- Driving practice on road for steering control.

UNIT -II

- Study of service manual of a new vehicle (Maruti/Tata/Hyundai etc.) as per manufacturer's recommendation.
- Removal, inspection and refitting of steering wheel, steering box, pitman arm, tie rod and knuckle joint.
- Removal and refitting of various auto body assemblies
- Demonstration of body repair techniques.
- Testing of battery - specific gravity test using hydrometer, voltage test, high rate discharge test; Charging of battery using battery charger.
- Testing of field winding of alternator and armature of starter motor for open circuit, short circuit and earthing.

UNIT-III

- Testing and setting of Ignition timing, measurement and adjustment of spark plug gap.
- Engine testing and finding out fuel consumption
- Setting of valve timing and adjustment of tappet clearance.
- Removal and refitting of propeller shaft and universal joints.
- Service and repair of starter motor drive.
- Replacement of drive axles.
- Demonstration of Electric Vehicle working.

RECOMMENDED BOOKS

1. Car Maintenance and Repair by Arthur W. Judge
2. Automobile Engineering Vol. I & II by Dr. Kirpal Singh; Standard Publisher, Delhi.
3. A to Z of Automobile Engineering by Dr. Kirpal Singh, Standard Publishers Distributors, Delhi
4. Automobile Engineering by Sh. R.B. Gupta; Satya Prakashan, New Delhi.
5. Maintenance and Repair of Motor Vehicle by H.O. Geneva; Dialogue, R-686, New Rajinder Nagar, New Delhi.

6. Automotive Mechanics by William H. Crouse, Tata McGraw Hill, Delhi.
7. Auto Mechanics: Theory & Service by W.J.deKryger et al.

RECOMMENDED WEBSITES

1. https://swayam.gov.in/explorer

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and students should be given opportunities to conduct experiments lab regularly for development of required skills among them. During practice work, it should be ensured that students get opportunity to individually perform practical tasks. Field and industrial visits should be arranged at intervals to enable the students understand fault-diagnosis and trouble-shooting techniques being followed in the world of work. Teachers should divide the class into three groups for the three units for efficient and streamlined practice and learning. The teachers should guide the students to follow safety rules, make the students proficient on simulator before going to physical training on vehicle and provide hands-on practice. The students should be asked to identify the various components and arrange them in order while dismantling/removal. They should also be exposed to relevant tools and equipment.

5.7 MINOR PROJECT

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RATIONALE

Minor project work will help in developing the relevant skills among the students as per National Skill Qualification Framework. It aims at exposing the students to the present and future needs of various relevant industries. It is expected from the students to get acquainted with desiredattributes for industrial environment. For this purpose, students are required to be involved in Minor Project Work by apply the knowledge and skills gained through course work.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Define the problem statement of the minor project according to the need of industry.

CO2: Work as a team member for successful completion of minor project.

CO3: Write the minor project report effectively.

CO4: Present the minor project report using PPT.

CO5: Presentation Skills development.

GUIDELINES

Depending upon the interest of the students, they can develop minor projects as per present and future demand of the industry. The supervisors may guide the students to identify their minor project work and prepare their plan of action well in advance. As a minor project activity each student is supposed to study the operations and prepare a detailed project report of the operations/processes/activities. The supervisor may create a group of 5-6 students as per their interest to work as a team for successful completion of the minor project. Necessary infrastructure and facilities of workshop and other labs will be provided for executing the minor projects.

The supervisor shall evaluate the students along with one external expert by considering the following parameters:

	Parameter	**Weightage**
I	Selection of minor project	20%
ii	Innovation / creativity	20%
iii	Performance, responsibility	20%
iv	Report Writing	20%
v	Viva -voce / presentation	20%

SIXTH SEMESTER

6.1	Automobile Engineering	176-178
6.2	Metrology and Quality Control	179-181
6.3	Entrepreneurship Development and Management	182-184
6.4	Programme Elective II	185-191
6.5	Major Project	192-193

6.1 MOTOR VEHICLE ACT AND GARAGE MANAGEMENT

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RATIONALE

A diploma holders in automobile engineering are supposed to have knowledge about significance of vehicle accident, accidental vehicle claim procedure from insurance company and about important aspects of Motor Vehicle Act. Also, they should be able to manage garage as it forms an important function of automobile technicians.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1 Explain salient features of the Motor Vehicle Act
CO2 Outline the various types of vehicle insurances and their claim settlement procedure
CO3 Manage an automobile garage
CO4 Use the special garage tools
CO5 Describe fundamentals of transport management

DETAILED CONTENTS

UNIT I

Motor Vehicle Act - Main Provisions

Salient features of Motor Vehicle Act; Requisites and formalities for: Licensing of drivers and conductors of motor vehicles, Registration of old and new vehicles; Control of transport vehicles & permits; Transfer of vehicle - Local transfer and State-to-State transfer; Traffic offences, penalties and procedures; Amendments in Motor Vehicle Act from time to time.

UNIT II

Inspection and Fitness of Vehicle

Inspection and Fitness of vehicle – meaning, purpose and provisions in the act; Detailed procedure and requirements for vehicle inspection; Road Worthiness requirements.

Insurance of Vehicles

Meaning of Insurance and its necessity; Different types - comprehensive and third party insurance, concept of zero depreciation insurance; Procedure to get Accidental claim and compensation; Duties of surveyor; Relation between Insurance company and surveyor; Duties of driver and conductor in case of accident and injury to a person; Analysis & estimation of accident loss.

UNIT III

Garage Management

Meaning of Garage; Types of garages; Location and layout of a modern garage; Service station and its functions; Difference between garage and service station; Spare parts section and dealership service section; Accounts and books; Service break-even; Different types of job cards and their use in maintaining service station records; Role of Service advisor and works manager.

Procedure to start an auto garage and car dealership; Types of equipment to start an auto repair shop; Benefits of car dealership; Challenge in car dealership .

UNIT IV

Special Purpose Garage Tools & Equipment

Types/specifications/working and use of: Torque wrench, Tools for tubes flaring, grease gun, tyre changer, spark plug cleaner and tester, fuel injector tester, piston ring compressor, piston ring remover, cylinder dial gauge, valve lifter, push-pull gauge to measure pedal travel, Hydraulic and electric hoist; Engine scanner.

UNIT V

Transport Management

History of transport with special reference to road transport in India; Modes of Road transport; Structure of fleet organization; State transport - optimum utilization of fleet; vehicle routing: meaning and method; theory of fares/freight; Maintenance of logbook and history sheet; Assessment of used vehicles for sale and purchase. Uses of web portals like vahan, mprivahan, saarthi etc.

RECOMMENDED BOOKS

1. Automobile Engineering Vol. I by Dr. Kirpal Singh, Standard Publishers, Distributors, Delhi.
2. Transport Management Vol. III & IV by Central Institute of Road Transport, Pune.
3. Motor Vehicle Act and Transport management by V.S. Khilery, Ishan Publications
4. Motor Vehicle Act with Rules by B.S. Kohli.

5. Motor Transportation: Principles and Practices by WJ Hudson and James; Ronald Press Company, New York.
6. Transport in Modern India by KP Bhatnagar, Satish Bahadur, DN Aggarwal and SC Gupta.
7. Central Motor Vehicle Rules.
8. Garage Equipment by Raj Kumar Chauhan, North Publication
9. E-books/e-tools/relevant software as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://morth.nic.in/sites/default/files/Motor-Vehicle-Driving-Regulation-2017.pdf
https://www.slideshare.net/slideshow/motor-vehicle-act-road-safety-garage/249486631
https://vikaspedia.in/social-welfare/social-awareness/consumer-education/safe-driving/motor-vehicles-driving-regulations-2017
https://swayam.gov.in/explorer

INSTRUCTIONAL STRATEGY

This subject contains five units of equal weightage. While imparting instructions, focus should be on conceptual understanding. Training slides and videos should be used to supplement the classroom teaching. Teachers should invite experts from the industries, research and higher level organizations/institutions to engage some sessions on the latest developments taking place on the subject. Some industrial and field visit may also be arranged. Teachers should lay emphasis on basic principles and practices covering Motor Vehicle Act and garage management. Visits should be organized to auto garage for better understanding of topics.

6.2 AUTO PROFESSIONAL AND DRIVING PRACTICE-II

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RATIONALE

Acquiring professional skills is the most important part of learning for an automobile diploma student. This subject is required to learn about overhauling of various automobile systems so as to get them back in proper working order. Driving skills are essential requirement for an automobile engineer. In this subject, the students will learn about driving and skills related to inspection, testing, repair and overhauling of various engine, chassis and body assemblies in automobiles.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1 Drive four wheeled passenger vehicle independently and under abnormal weather conditions
CO2 Inspect a vehicle thoroughly for damage and insurance claims.
CO3 Diagnose the engine problems, remove and refit the engine in a vehicle
CO4 Overhaul petrol and diesel engines,
CO5 Overhaul various chassis and transmission components

PRACTICAL EXERCISES

UNIT-I

Driving practice on road to gain proficiency
Maneuver in: Passing, Merging, Diverging, Overtaking, Crossing, Turning, Cornering, Reversing and Emergency stopping
Driving on gradient – uphill & downhill
Driving during abnormal weather conditions like hilly area, night, fog, heavy traffic, rain
Inspection of Vehicle for resale/ insurance claim in case of accident

UNIT-II

Diagnosing the engine for overhauling
Removal of engine from vehicle
Dismantling of engine

Overhauling of petrol/diesel Engine

Decarbonizing and cleaning of engine blocks, combustion chamber, piston crown and valve parts
Inspection and testing of cylinder bore using cylinder dial gauge for ovality & taperness
Inspection of piston, piston ring grooves and gudgeon pin for wear
Testing of connecting rod for bend, bow and twist
Inspection of crankshaft - bearing replacement and setting of main journal & big end bearings; measuring bearing clearances by gauges
Surface testing and resurfacing of cylinder heads, cylinder blocks and manifolds on surface grinding machine
Removal and refitting of cylinder liners
Assembling of the engine after replacing/repairing defective/worn-out parts
Engine testing for performance

UNIT-III

Overhauling of valves and valve mechanism
Overhauling of gear box
Overhauling of differential and propeller shaft
Overhauling of wheels and axles
Overhauling of brakes
Overhauling of clutch

UNIT-IV

Use of dial indicator for measuring taper.
Use of combination set, bevel protector and sine bar for measuring taper.
Measurement of thread characteristic using vernier and gauges.
Use of slip gauge in measurement of center distance between two pins.
Use of tool maker’s microscope and comparator.
Plot frequency distribution for 50 turned components.
With the help of given data, plot X and R, P and C charts

RECOMMENDED BOOKS

1. Car maintenance and repair by Arthur W. Judge
2. Automobile Engineering Vol. I & II by Dr. Kirpal Singh; Standard Publisher, Delhi.
3. Automobile Engineering by Sh. R.B. Gupta; Satya Prakashan, New Delhi.
4. Maintenance and Repair of Motor Vehicle by H.O. Geneva; Dialogue, R-686, New Rajinder Nagar, New Delhi.
5. Automotive Mechanics by William H. Crouse, Tata McGraw Hill, Delhi. 6. Auto Mechanics: Theory & Service by W.J.de Kryger et. all.

RECOMMENDED WEBSITES

1. https://swayam.gov.in/explorer

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and students should be given opportunities to conduct experiments lab regularly for development of required skills among them. During practice work, it should be ensured that students get opportunity to individually perform practical tasks. Field and industrial visits should be arranged at intervals to enable the students understand fault-diagnosis and trouble-shooting techniques being followed in the world of work. Teachers should divide the class into three groups for the three units for efficient and streamlined practice and learning. The teachers should guide the students to follow safety rules, make the students proficient on simulator before going to physical training on vehicle and provide hands-on practice. The students should be asked to identify the various components and arrange them in order while dismantling/removal. They should also be exposed to relevant tools and equipment.

6.3 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

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RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Explain the importance of entrepreneurship and its role in nation's development.
CO2: Classify the various types of business and business organizations.
CO3: Identify the various resources / sources and / or schemes for starting a new venture.
CO4: Explain the principles of management including its functions in an organisation.
CO5: Conduct market survey and prepare project report.

DETAILED CONTENTS

UNIT I

Entrepreneurship: Concept and definitions, classification and types of entrepreneurs, entrepreneurial competencies, Traits / Qualities of entrepreneurs, manager v/s entrepreneur, role of Entrepreneur, barriers in entrepreneurship, Sole proprietorship and partnership forms of business organisations, small business vs startup, critical components for establishing a start-up, Leadership: Definition and Need, Manager Vs leader, Types of leadership

UNIT II

Definition of MSME (micro, small and medium enterprises), significant provisions of MSME Act, importance of feasibility studies, technical, marketing and finance related problems faced by new enterprises, major labor issues in MSMEs and its related laws, Obtaining financial assistance through various government schemes like Prime Minister Employment Generation Program (PMEGP) Pradhan Mantri Mudra Yogna (PMMY) , Make in India, Start up India, Stand up India , National Urban Livelihood Mission (NULM); Schemes of assistance by entrepreneurial support agencies at National,

State, District level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).

UNIT III

NATURE AND FUNCTIONS OF MANAGEMENT: Definition, Nature of Management, Management as a Process, Management as Science and Art, Management Functions, Management and Administration, Managerial Skills, Levels of Management; Leadership.

PLANNING AND DECISION MAKING: Planning and Forecasting - Meaning and definition, Features, Steps in Planning Process, Approaches, Principles, Importance, Advantages and Disadvantages of Planning, Types of Plans, Types of Planning, Management by Objective. Decision Making-Meaning, Characteristics.

UNIT IV

ORGANISING AND ORGANISATION STRUCTURE: Organising Process - Meaning and Definition, Characteristics Process, Need and Importance, Principles, Span of Management, Organisational Chart - Types, Contents, Uses, Limitations, Factors Affecting Organisational Chart.

STAFFING: Meaning, Nature, Importance, Staffing process. Manpower Planning, Recruitment, Selection, Orientation and Placement, Training, Remuneration.

CONTROLLING AND CO-ORDINATION Controlling - Meaning, Features, Importance, Control Process, Characteristics of an effective control system, Types of Control. Co-ordination - characteristics, essentials.

UNIT V

Market Survey and Opportunity Identification, Scanning of business environment, Assessment of demand and supply in potential areas of growth, Project report Preparation, Detailed project report including technical, economic and market feasibility, Common errors in project report preparations, Exercises on preparation of project report.

RECOMMENDED BOOKS

1. Entrepreneurship Development and Management by Dr. Ranjana Verma, Dr. Sangeeta, Dr. Pooja Sharma; Anant Publications, Ambala City.
2. BS Rathore and Dr JS Saini, "A Handbook of Entrepreneurship", Aapga Publications, Panchkula (Haryana).

3. Entrepreneurship Development, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. CB Gupta and P Srinivasan, “Entrepreneurship Development in India”, Sultan Chand and Sons, New Delhi.
5. Poornima M Charantimath, “Entrepreneurship Development - Small Business Enterprises”, Pearson Education, New Delhi.
6. David H Holt, “Entrepreneurship: New Venture Creation”, Prentice Hall of India Pvt. Ltd., New Delhi.
7. PM Bhandari, “Handbook of Small Scale Industry”.
8. L M Prasad, “Principles and Practice of Management”, Sultan Chand & Sons, New Delhi.

RECOMMENDED WEBSITES

1. https://ipindia.gov.in/

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment or seminar method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided. In addition, different activities like conduct of entrepreneurship awareness camp extension lecturers by outside experts, interactions sessions with entrepreneurs and industrial visits may also be organised. This subject contains five units of equal weightage.

6.4 PROGRAMME ELECTIVE-II
6.4.1 TRACTOR AND SPECIAL PURPOSE VEHICLES

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RATIONALE

Diploma holders in Automobile Engineering may have to deal with repair and maintenance of tractors and earth moving machinery. This subject provides knowledge about such vehicles and equipment.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1 Classify the tractors and describe their applications
CO2 Explain the working of chassis components and supplementary systems of tractor
CO3 Explain the functions of hydraulic system of tractor
CO4 Write specifications of wheels and tyres of tractor
CO5 Elucidate comfort and safety issues of operator of tractor
CO6 Identify maintenance checks and common faults in tractors
CO7 Describe the working principles of earth moving machinery like loader, cranes, excavator, forklift truck dumper etc.

DETAILED CONTENTS

UNIT-I

Tractor Fundamentals

Definition; Classification of tractors according to – horse power, running gear, purpose, power source, drive wheels; Characteristics and uses of - general purpose tractor, row crop tractor, power tiller, other special purpose tractors; Major assemblies of tractor and their functions; Basics trends in tractor design; Applications of tractors; Drawbar Pull, Rolling Resistance & Tractive Effort; Weight transfer concept.

Tractor Chassis

Types of clutch used in tractors and their working – Single clutch, dual clutch & double clutch; Types

of transmission boxes used in tractors; Final drive reduction gear – bull gear type, planetary type; Tractor brake system – oil immersed disc brakes;

UNIT-II

Supplementary Systems

Power take off shaft; Types of PTO shaft; Types of PTO drive - Transmission drive PTO, Independent drive PTO, Continuously drive PTO (Live PTO); Belt pulley drive; Three point linkages; Types of drawbar: fixed, swinging, 3-point linkage drawbar; Tractor hitching system – Trailed, semi-mounted, fully mounted; Differential lock: necessity and method of operation; Description of dog clutch type differential lock.

UNIT-III

Hydraulic system

Principle and Functions of hydraulic system, Hydraulic system layout and working; Various components of hydraulic system, their types, and their working – reservoir, hydraulic pump, direction flow control valve, power cylinder; Various control systems – depth control, position control, draft control, combination control. Working of hydraulic control levers; Other uses of hydraulic control system.

UNIT-IV

Tractor Wheels and Tyres

Function of tyres; Salient features of tractor wheels & tyres; Definition of wheel base, wheel tracks and ground clearance; Classification of tractor tyres according to - tyre pressure, type of tread, application; Specifications of front and rear tyres; dual tyre and tandem tyre arrangements.

Tractor Comfort & Safety

Human factors considered while designing a tractor; Operator's seat design; Tractor stability-longitudinal and lateral stability; Tractor safety – color codes, symbols, Roll-Over Protection System (ROPS), PTO shield, seat belt; Safe tractor operating procedure.

Tractor Operation, Maintenance & Repair

Common controls and levers; Maintenance checks before starting the engine; Periodic maintenance procedure of tractor; Common faults and their rectification; Prominent makes of Indian tractors, Selection criteria for tractor.

UNIT-V

Special Purpose Vehicles

Earth Moving Machinery – definition, classification; General layout and classification of earth moving machinery; Layout, working and applications of: Tipper, Dozer, Loader, Excavator, Motor grader, Fork Lift Truck, Mobile Crane; Definition of crane terms – derricking, hoisting, slewing.

RECOMMENDED BOOKS

1. Farm Machines and Equipment by CP Nakra; Dhapat Rai and Sons, New Delhi.
2. Manual of Tractors by J Konard; Asia Publishing House, Mumbai.
3. Tractors and Agriculture Equipment by SC Jain and CR Roy; Standard Publisher Distributers, New Delhi.
4. Agriculture Engineering by Michael and Ojha; Jain Brothers, New Delhi.
5. Tractor Design and Testing by Dr. Manjit Singh and Dr. LN Shukla; https://agrimoon.com
6. E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This subject contains five units of equal weightage. While imparting instructions, focus should be on conceptual understanding. Training slides and videos should be used to supplement the classroom teaching. Teachers should invite experts from the industries, research and higher level organizations/institutions to engage some sessions on the latest developments taking place on the subject. Some industrial and field visit may also be arranged. The students may be taken to workshops dealing in repair of tractors and heavy earth moving machinery and given practical demonstration.

6.4.2 PRODUCTION ENGINEERING

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RATIONALE

A diploma holder in Automobile Engineering is supposed to look after the planning, scheduling and production control activities in the industry. He/she is also required to have knowledge and relevant skills about cost estimation of new and repaired components, material management, quality aspects and productivity.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1	Measure productivity
CO2	Describe assembly line system
CO3	Apply the principles of costing in product costing
CO4	Apply the principle and techniques in production planning and control of a production system
CO5	Ensure quality by using different levels of inspection techniques of various stages of Production
CO6	Use different marketing and sales techniques

DETAILED CONTENTS

UNIT-I

Productivity

Definition of Production
Types of Production – Job, Batch and Mass production, Assembly Production,
Definition of productivity,
Difference between production and productivity
Importance of productivity
Factors affecting productivity,
Measurement of productivity
Causes of decrease in productivity

Assembly Systems and Line Balancing:

The assembly process,
Assembly system,
Manual assembly lines,
Line balancing problems – static balancing and dynamic balancing,

UNIT-II
Production Planning and Control

Necessity of planning and control
Functions of production, planning and control department,
Advantages of Production Planning & Control
Preplanning – product development, sales forecasting, Break-even analysis
Process planning, Process planning sheet, calculation of man and machine hours
Stages of P.P.C. - process planning, routing, loading, scheduling, dispatching, follow-up, inspection and evaluation; their purpose and procedure
Gantt chart - Order Control Gantt Chart, Machine load Gantt chart.
Inventory control – need and benefits; ABC, JIT and Kanban System

UNIT-III
Inspection

Inspection - Need and Planning for Inspection
Modes of inspection – Accuracy testing of machine tools, Part/Product inspection, Process quality control
Types of Inspection – in-coming, in-process and final inspection; remedial, preventive and operative inspection
Methods of inspection – 100% inspection, sampling inspection
Role of Operator and Inspector in Inspection

Quality Control

Quality Control and Quality Assurance – Meaning, Need and responsibilities of quality assurance department
Statistical Quality Control and its benefits.
Acceptance Sampling
Control Charts for variables and Attributes
QC tools – Control chart, histogram, flow chart
Concept of Six Sigma
Concept of Total Quality Management (TQM)
Introduction to 5S and Kaizan technique.
Quality Management system (ISO 9000), Environment Management system (ISO14000)

UNIT-IV

Estimating and Costing

Meaning and importance of estimating and costing

Difference between estimating and costing.

Estimating procedures.

Elements of cost – Material cost – direct and indirect, Labor cost – direct and Indirect, Expenses – direct and indirect, overheads.

Profits – Concepts and requirements

Variable and fixed cost, production cost

UNIT-V

Marketing and Sales

Concept of marketing and sales,

Difference between sales and marketing

Types of marketing – through personal contact, through advertisement, through demonstration, multilevel marketing,

Market research – definition, necessity and objective

Types of sales

Consumer Behavior, factors determining consumer behavior

RECOMMENDED BOOKS

1. Production Estimating and Costing by M. Adithan and B.S. Pabla, Konark Publishers, Delhi
2. Industrial Engineering and Management by T.R Banga, and S.C. Sharma, Khanna Publishers, Delhi
3. Production Engineering by Shaman Gupta, Ishan Publication, Jalandhar
4. Production Engineering by PC Sharma, S. Chand & Company Ltd., New Delhi
5. e-books/e-tools/relevant software as recommended by AICTE/HSBTE/NITTTR

RECOMMENDED WEBSITES

1. https://www.shiksha.com/studyabroad/germany/universities/technische-hochschule-ingolstadt/master-of-engineering-in-automotive-production-engineering
2. https://cordis.europa.eu/project/id/612207/reporting/de
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This subject contains five units of equal weightage. While imparting instructions, focus should be on conceptual understanding. Training slides and videos should be used to supplement the classroom teaching. Teachers should invite experts from the industries, research and higher level organizations/institutions to engage some sessions on the latest developments taking place on the subject. Some industrial and field visit may also be arranged. Efforts should be made to relate process of teaching with direct experiences in the industry. Students should also be taken to various industrial enterprises for better conceptualization of specific topics such as production planning, inspection and quality control. Simple problems on costing should be given to students for better comprehension.

6.5 MAJOR PROJECT/INDUSTRIAL TRAINING

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RATIONALE

Major project / Industrial training work will help in developing the relevant skills among the students as per National Skill Qualification Framework. It aims at exposing the students to the present and future needs of various relevant industries. It is expected from the students to get acquainted with desired attributes for industrial environment. For this purpose, students are required to be involved in industrial training / Major Project Work in different establishments.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Define the problem statement of the Industrial training / Major project according to the need of industry.

CO2: Work as a team member for successful completion of Industrial training / Major project.

CO3: Write the major project/industrial training report effectively.

CO4: Present the major project/industrial training project report using PPT.

GUIDELINES

Depending upon the interest of the students, they can go for Industrial training / Major project as per present and future demand of the industry. The supervisors may guide the students to identify their project work and chalk out their plan of action well in advance. As an Industrial training / Major project activity each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes/activities. The supervisor may create a group of 4-5 students as per their interest to work as a team for successful completion of the Industrial training / Major Project.

The supervisor shall evaluate the students along with one external industry / academic expert by considering the following parameters:

	Parameter	**Weightage**
I	Defining problem statement, focus and approach	20%
ii	Innovation / creativity	20%
iii	Report Writing	20%
iv	Power Point Presentation	20%
v	Viva - voce	20%

24. ASSESSMENT TOOLS & CRITERION

The assessment is carried out by conducting:

1. Formative assessments
2. Summative assessments

1. FORMATIVE ASSESSMENT

The **formative assessment** will be evaluated on the basis of the internal assessments for theory subjects and practical by the concerned teachers for evaluating the knowledge and skill acquired by students and the behavioral transformation of the students. This **internal assessment** is primarily carried out by collecting evidence of competence gained by the students by evaluating them at work based on assessment criteria, asking questions and initiating formative discussions to assess understanding and by evaluating records and reports, and sessional marks are awarded to them.

2. SUMMATIVE ASSESSMENT

The **summative assessment** will include end semester examination for theory part for each candidate and practical examination with viva voice. Each Performance Criteria will be assigned marks proportional to its importance and proportion of marks for Theory and Skills Practical for each subject should be laid down.

The following assessment tools are used for effective student evaluation:

1. Theory Examinations
2. Practical Work
3. Internships
4. Professional Industrial Training
5. Project Work (Minor & Major)
6. Massive Open Online Courses (MOOCs)
7. Viva Voce
8. Case Studies

1. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems.

The **formative evaluation** for theory subjects may be caused through

i. Sessional /class-tests,
ii. Quizzes,
iii. Assignments,
iv. Seminars/ Presentations
v. Attendance
vi. Case Studies

For **Summative evaluation** of theory, the question paper may comprise of three sections.

i. It should contain objective type question and multiple choice questions. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.
ii. It should contain short answer questions.
iii. Descriptive type questions , with some internal choice of the questions set may be given in this section

2. Practical Assessment

Evaluation of students performance in practical work (Laboratory experiments, Workshop practical /field exercises) aims at assessing students ability to apply or practice the concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. This will comprise of a creation of mock environment, wherever applicable in the skill lab which is equipped with all required equipment for development of desired skills. Candidate's soft skills, communication, aptitude, safety consciousness, quality consciousness etc. will be ascertained by observation and will be marked in observation checklist along with the assessment of Job carried out in labs and maintenance of Lab Record files.

Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behavior and it should be followed by viva-voce of the relevant subject. The end product will be measured against the specified dimensions and standards to gauge the level of his skill achievements

3. Internship

The two mandatory internships after I Year and II Year of the programme are to be assessed in 3rd and 5th semester subsequently. The internships should be preferably done in the field/ in the industry, can be in house depending upon the stream and availability of resources in and around the institute.

Every faculty should be assigned the students and made responsible for the evaluation and assessment of the internship. Formative assessment should be taken from the industry/institute/ department on the basis of performance, behavior and learning capabilities. Summative evaluation may comprise of weightages on the basis of report submission/ presentation followed by viva-voce of the relevant subject.

4. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behavior and it should be followed by viva-voce of the relevant subject.

The formative assessment should include the evaluation from the employer where the student is doing his training or Project work in the ratio of 40:60. The final assessment will be the combination of the employer assessment and evaluation by the faculty of the institute which shall include report submission/ presentation/ seminar followed by viva-voce of the relevant subject.

5. Project Work Assessment

The purpose of evaluation of project work is to assess student's ability to apply, in an integrated manner, knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The project work assigned should be of

relevance to the core skill, state of the art topics and the project areas that are pertaining to enhance job skill and enhance occupational opportunities. For both, minor and major project, Formative and summative evaluation may comprise of weightages to performance on task, quality of product, nature and relevance of project and general behavior.
The formative assessment should include the continuous assessment based on the work allocated and mid semester viva voice or presentation. The final assessment will be the combination of the project undertaken, report submission and should be followed by viva-voce of the relevant subject.

In case of the assessment of this component, the team of examiners should be constituted on 50 – 50 % basis. i.e. half of the examiners in the team should be invited from outside the institute conducting examination.

6. MOOC COURSES (Open Elective and Multi-Disciplinary Elective)

Massive Open Online Courses (MOOCs) platforms promise open, online courses to massive numbers of students as they are free to join, they provide a wide range of courses, they allow for space and time flexibility and their participants can benefit from various online communication tools and access to quality content.

The coordinating Department/Centre/Office shall monitor every student to adopt the courses online of their choice and preference on Swayam portal. The duration of courses will vary depending on the level and credit points. Courses offered in the duration of 4-10 weeks for 2 to 3 credits at diploma level are to be opted. Students, after they have registered, can get a certificate after attending the classes and submitting the assignments/quizzes and qualifying nationwide exam conducted written exam at the institute close to the one where the student is enrolled.

On successful completion of each course, the institution offering the MOOCs course would issue the certificate, along with the number of credits and grades, through which the student can get credits transferred into his marks certificate issued by his parent institution. Guidelines for credit sharing will be issued by concerned Regulators such as UGC, AICTE, etc. for consideration by various Institutes. There may be standard norms for the host Institution to conduct the course that may include continuous evaluation through assignments, online quizzes, case studies, online writing exercises, term examinations, student feedback, online forum management, etc.

The coordinating Department/Centre/Office of the respective department shall monitor every student and submit to the Office of Examinations, a score sheet (marks card) during the last 10 days prior to the close of the even semester.

7. Viva Voce

This tool will be used to assess the conceptual understanding and the behavioral aspects as regards the job role and the specific task at hand. It will also include questions on safety, quality, environment and equipment's etc. Ask questions on non-prescribed tasks to ensure that the learners have complete knowledge on the assessment

Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the marks scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA\ (Si) = \sum(Ci \times Gi) / \sum Ci$$

where Ci is the number of credits of the ith course and Gi is the marks scored by the student in the ith course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \sum(Ci \times Si) / \sum Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

25. TEACHING LEARNING TOOLS FOR EFFECTIVE IMPLEMENTATION

For effective implementation of curriculum, the faculty and staff of institutions have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that only a proper mix of different teaching methods in all these places of instruction can bring the changes in students behavior as stipulated in the curriculum document. It is important to understand curriculum document holistically and further be aware of intricacies of Teaching-Learning Tools for achieving curriculum objectives. Given below are certain recommendations which may help in carrying out teaching-learning effectively:

PROGRAMME LEVEL RECOMMENDATIONS

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared at institute level. The Head of the institute have a great role to play in its dissemination and percolation up to grass-root level.

3. Head of Department are required to prepare academic plan at department level referring to institutional academic plan.

COURSE LEVEL RECOMMENDATIONS

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives. Teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period which is made available to them in the academic plan at Board level. With the amount of time to their credit, it is essential for them to use it judiciously by planning all above activities properly and ensure execution of

the plan effectively. Following is the gist of suggestions for subject teachers for effective utilization of Teaching Learning Tools to achieve the course objectives:

1. Teachers need to ensure attainment of course outcomes so as to help the students achieve program outcomes and also meet the desired learning outcomes in five domains of NSQF i.e. Process, Professional knowledge, Professional skills, Core skills and Responsibility.

2. Teachers are required to prepare a course plan, taking into account number of weeks available and courses to be taught.

3. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan.

4. Teachers are required to plan for expert lectures from field/industry. For this, necessary steps need to be taken such as planning in advance, identifying field experts, making correspondence to invite them, taking necessary budgetary approval etc.

5. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.

6. Concept based industrial/field visits may be planned and executed for such contents of course which are abstract in nature and no other requisite resources are readily available in institute to impart them effectively.

7. Lot of focus needs to be laid on skill development. There is need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning and experiential learning effectively. The development and use of lab manuals will enable the institutes to provide lab experiences effectively.

8. Emphasis should to lay on developing soft skills like communication skills, personality Development, self-learning, inter personal skills, problem solving, and creativity etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time. While teaching, the teacher should make

extensive use of audio visual aids such as video films, power point presentations and IT tools.

10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

11. Students be made aware about issues related to ecology and environment, safety, concern f for wastage of energy and other resources etc.

12. To enhance digital learning, open electives and multi-disciplinary electives have been provided in the curriculum to be taken up in the form of MOOCs. For Open electives, some courses may be identified out of the prescribed list given in the curriculum keeping in mind the interest of students. Similarly, for multi-disciplinary electives, courses to be o offered may be identified by considering their relevance and utility. Every year SWAYAM is notifying the list of courses which are going to be offered in forthcoming even and odd semester. The institute needs to select the courses that are offered on SWAYAM platform or any other online platform.

13. For effective implementation of Massive Open Online Courses (MOOCs), a faculty member in the department may be identified and given the responsibility to coordinate various activities related to MOOCs. The concerned faculty member will facilitate in registration of students for MOOCs. The faculty member will also be responsible for compiling the result of students on the completion of MOOCs and pass on the information to the concerned authority.

14. Flexibility has been provided in the curriculum for the students to choose a course related to the discipline as per their interest. For effective implementation of discipline-specific electives, the institute should identify some courses from the list of courses prescribed in the curriculum. The courses should be selected and offered keeping in mind the interest of students, infrastructure and expertise available in and around the institute related to the courses. Option for discipline-specific elective may be taken from students through a form and a course, with more than 10 students opting for it, may be run.

15. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time. While teaching, the teacher should make extensive use of audio visual aids such as video films, power point presentations and IT tools.

16. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

17. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

18. To enhance digital learning, open electives and multi-disciplinary electives have been provided in the curriculum to be taken up in the form of MOOCs. For Open electives, some courses may be identified out of the prescribed list given in the curriculum keeping in mind the interest of students. Similarly, for multi-disciplinary electives, courses to be offered may be identified by considering their relevance and utility. Every year SWAYAM is notifying the list of courses which are going to be offered in forthcoming even and odd semester. The institute needs to select the courses that are offered on SWAYAM platform or any other online platform.

26. LIST OF EXPERTS

1. Controller of Examination, Haryana State Board of Technical Education, Panchkula.
2. Controller of Administration & Finance, Haryana State Board of Technical Education, Panchkula.
3. Joint Secretary, Haryana State Board of Technical Education, Panchkula.
4. Deputy Secretary, Training & Placement, Haryana State Board of Technical Education, Panchkula.
5. Deputy Secretary, Examination, Haryana State Board of Technical Education, Panchkula.
6. Deputy Secretary, Academic, Haryana State Board of Technical Education, Panchkula.
7. Assistant Secretary, Academic, Haryana State Board of Technical Education, Panchkula.
8. Sh. Ashok Poonia, Senior Manager, Maintenance, Casting Maruti Udyog Ltd., Haryana.
9. Sh. Sunil Kumar, Senior Manager, Redlands Ashlyn Motors PLC, North India.
10. Sh. Hitesh Kumar, Deputy Secretary (T&P), Haryana State Board of Technical Education, Panchkula, Haryana.
11. Sh. Vijay Singh, Senior Lecturer, Automobile Engineering Department, Government Polytechnic, Ambala City, Haryana.
12. Sh. Ravinder Singh, Senior Lecturer, Automobile Engineering Department, Government Polytechnic, Ambala City, Haryana.
13. Sh. Navneet Gupta, Lecturer, Automobile Engineering Department, Government Polytechnic, Ambala, Haryana.
14. Sh. Raj Kumar Chauhan, Sr. Lecturer, Automobile, G.P. Sadhaura.
15. Sh. Dinesh Jain, VTI, Rohtak, Haryana.
16. Sh. Yashpal, Mohindra & Mohindra, Phase IV Mohali.
17. Sh. A.S. Thakur, Mohindra & Mohindra, Phase IV Mohali.
18. Sh. M.M. Singh, General Manager (Retd.), Hero Motors, Rewari, Haryana.
19. Sh. D.K. Jain, Lecturer, Automobile Engineering Department, Vaish Technical Institute, Rohtak, Haryana.
20. Sh. Jagjit Singh Narang, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Ambala, Haryana.

21. Sh. Subhash Chandra Bhoria, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Hisar, Haryana.

22. Sh. Harvinder Singh Saini, Senior Lecturer, Mechanical Engineering Department, Senior Lecturer, Government Polytechnic, Ambala, Haryana.

23. Subhash Bhardwaj, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Ambala, Haryana.

24. Sh. Pardeep Kumar, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Nilokheri, Haryana.

25. Sh. Vikas Sharma, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Nilokheri, Haryana.

26. Sh. Rajiv Verma, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Adampur, Haryana.

27. Sh. Parveen Saini, Lecturer, Mechanical Engineering Department, Government Polytechnic, Nilokheri, Haryana.

28. Sh. Baljeet Siwach, Lecturer, Mechanical Engineering Department, Government Polytechnic, Sonepat, Haryana.

29. Sh. Kapil Sharma, Lecturer, Mechanical Engineering Department, Seth Jai Parkash Polytechnic, Damla, Haryana.

30. Sh, Baltar Singh, Workshop Superintendent, Mechanical Engineering Department, Government Polytechnic, Ambala, Haryana.

31. Sh. Dinesh Mor, Workshop Superintendent, Workshop Department, Government Polytechnic, Sonipat, Haryana.

32. Sh. Manmohan Singh, Workshop Superintendent, Mechanical Engineering Department, Government Polytechnic, Damla, Haryana.

33. Sh. Balwan Singh, Workshop In-charge, Mechanical Engineering Department, Aryabhatt Institute of Technology, Delhi.

34. Sh. Gulab Singh, Workshop Instructor, Mechanical Engineering Department, Seth Jai Parkash Polytechnic, Damla, Haryana.

35. Sh. Ashwani Kumar, Workshop Instructor, Electrical Engineering Department, Government Polytechnic, Damla, Haryana.

36. Sh. Rajneesh Rana, Workshop Instructor, Electronics Engineering Department,

Government Polytechnic, Damla, Haryana.

37. Sh. Ankush Aggarwal, Lecturer, Mechanical Engineering Department, Seth Jai Parkash, Polytechnic, Damla, Haryana.
38. Ms. Amita, Deputy Director (Acd), Directorate of Technical Education.
39. Dr. Bhajan Lal, Lecturer, Applied Science Department, Government Polytechnic for Women, Sirsa, Haryana.
40. Sh. Anil Nain, Lecturer, Applied Science Department, Government Polytechnic, Hisar, Haryana.
41. Dr. Sarita Mann, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.
42. Smt. Bindu Verma, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.
43. Dr. Pankaj Sharma, Professor, Applied Science Department, NITTTR, Chandigarh.
44. Dr. Ashok Kumar, Associate Professor, Applied Science Department, NITTTR, Chandigarh.
45. Smt. Pushpa Rani, Senior Lecturer, Applied Science Department, Government Polytechnic, Sonipat, Haryana.
46. Smt. Krishna Bhoria, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.
47. Smt. Preetpal Kaur, Guest Faculty, Applied Science Department, GovernmentPolytechnic, Ambala, Haryana.
48. Ms. Monika, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.
49. Dr Neena Sharma, English Department, MCM College, Chandigarh.
50. Sh. Satyawan Dhaka, Senior Lecturer, Applied Science Department, Government Polytechnic, Nilokheri, Haryana.
51. Mrs. Sapna Sang, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla. Haryana.
52. Sh. Ravi Bansal, Lecturer, Applied Science Department, Government Polytechnic, Manesar, Haryana.

53. Mrs. Kiran, Lecturer, Applied Science Department, Government Polytechnic, Sonepat, Haryana.

54. Dr. Naveen Jha, Assistant Professor, Department of Mathematics, Government Engineering College, Bharatpur.

55. Dr. KC Lachhwani, Assistant Professor, Applied Science, NITTTR, Chandigarh

56. Sh. KG Srinivasa, Professor CSE, IIIT-Naya Raipur.

57. Dr. Vidhi Grover, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.

58. Sh. Tavinder Singh, Lecturer, Applied Science Department, Government Polytechnic, Sirsa, Haryana.

59. Ms. Sunita Rani, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.

60. Dr. Rajesh Mehra, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh.

61. Dr. AB Gupta, Professor and Head, Education & Educational Management Department, NITTTR, Chandigarh.

62. Sh. PK Singla, Associate Professor, Curriculum Development Centre, NITTTR,Chandigarh.

63. Dr. SK Gupta, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh.

64. Dr. Meenakshi Sood, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh.

27. APPENDIX

Sr. No.	LIST OF EQUIPMENTS
1.	Air compressor 2 stage, twin cylinder, air cooled - Reciprocating type - oil splash lubricating – Driven by 5 HP -3 phase motor starter - with a working pressure gauge, Automatic pressure switch - safety valve, non-return valve
2.	Garage Lift (hoist) 4 Ton capacity single post with a stroke of 1500 mm
3.	Grease High pressure pump with a working ratio of 50:1 built in Air Regulator mounted on a 50 Kg drum with grease hose and trigger operated control valve
4.	Car washing machine with 3 HP motor
5.	Tyre inflator with twin hose assembly and small hose assembly
6.	Spark plug cleaning machine
7.	Tyre inflator assembly (portable)
8.	Pneumatic tyre changer for all vehicles - wheel disks upto 17" suitable for all cars (small cars and LCV)
9.	Condemned petrol engine of light petrol vehicle such as Maruti, Ambassador/Contessa, Premier Padmini with all fittings like manifolds, components of fuel system, cooling system, lubrication system, pistons, connecting rods, crankshaft assembly etc
10.	Condemned Diesel engine of medium and heavy vehicles such as Tata, Ashoka Leyland, Matador, Mahindra Nissan with all fittings like manifolds, components of fuel system, cooling system, lubrication system, pistons, connecting rods, crank shaft, assembly etc.
11.	Model of motor car engine
12.	Model of diesel engine
13.	Educational car model with cut out sections
14.	Cut out model of a fuel system of a multi cylinder petrol engine
15.	Cut out model of a multi cylinder diesel engine fuel system
16.	A.C. Mechanical fuel pump units
17.	S.U. Electrical fuel pump units
18.	Solex carburettor
19.	Maruti Carburettor
20.	Distributor type fuel pump
21.	Motor and scooter carburettor
22.	Condemned fuel injection pumps as a 6 cylinder engine with all fittings
23.	Condemned chassis frame of any light motor vehicle (Ambassador car/Maruti/Premier

	Padmini)
24.	Condemned chassis frame of heavy motor vehicle (Tata/ Ashoka Leyland)
25.	Condemned Tractor with engine, clutch, gear box and other standard mountings
26.	**Sectioned models of** a) Different types of pistons mounted in a board b) Different type of piston rings mounted on a board c) Different types of piston pins mounted on a board d) Different types of connecting rods mounted on a board e) Different types of oil pumps mounted on a board f) Water pump mounted on a board g) Different types of carburettors mounted on a board
27.	Sectioned working model of a single cylinder two stroke petrol engine
28.	Sectioned working model of single cylinder two stroke diesel engine
29.	Sectioned working model of a single cylinder four stroke diesel engine
30.	Sectioned working model of a single cylinder four stroke petrol engine fitted with ignition system Hand Operated Motor Operated
31.	Sectioned model of a shock absorber mounted on a board
32.	Sectioned model of a Radiator
33.	Sectioned model of a Wankel engine (working)
34.	Sectioned models of a. Self starter b. Dynamo c. Alternator d. Spark plug e. Ignition coil f. Speedometer g. Distributor h. Complete coil ignition system of a 4 cylinder engine fitted to a board i. Magneto ignition system of a single cylinder engine fitted to a board j. Horn circuit fitted to a board k. Complete electrical system with ignition, starter, lighting system mounted on a

	board l. Transmission with a Torque converter with Automatic Transmission
35.	Sectioned model of a scooter engine (any one type)
36.	Sectioned model of a motor cycle engine (any one type)
37.	Open end spanner 3 mm to 32 mm (set of 12 pcs)
38.	Double ended spanner 3 mm to 32 mm (one set of 12 pcs)
39.	Ring spanner, off set, 3 mm to 32 mm (complete set)
40.	Socket set with reversible ratchet (complete set)
41.	Adjustable spanner 250 mm long
42.	Torque wrench (dia type)
43.	Pipe wrench 300 mm size
44.	Screw driver, plastic handle 100 mm long
45.	Screw driver, Plastic handle 150 mm long
46.	Screw driver, plastic handle 200 mm long
47.	Screw driver, Phillip type plastic handle 3mm lip, 100 mm long
48.	Screw driver, Phillip type plastic handle 6 mm lip, 150 mm long
49.	Insulated electrician screw driver 150 mm long
50.	Combination (engineers') plier insulated 150 mm long
51.	Long - nose plier insulated, 150 mm long
52.	Self-grip, flat nose plier
53.	Allen key set, 1.5 mm to 12.4 mm sizes
54.	Round file, fine, double cut 150 mm long
55.	Steel rule 300 mm long
56.	Wire brush
57.	Scraper, flat blade, 150 mm long
58.	Scraper, angular blade, removable type 60 mm
59.	Twist drills set(3 mm to 15 mm)
60.	Steel measuring tape, 2 metres graduated in mm
61.	Tap set, 3 mm to 16 mm with drill set to match tap sizes
62.	Work bench
63.	Bench vice, 120 mm Jaw
64.	Digital tachometer to read up to 10,000 rpm
65.	Bearing puller
66.	Feeler gauge, 0.05 mm to 1.5 mm

67.	Ball pein hammer (wooden handle) about 0.5 kg weight
68.	Ball pein hammer (wooden handle) about 250 gm weight
69.	Plastic hammer about 300 gms weight
70.	Wooden hammer (Mallet)
71.	Rubber hammer about 500 kg weight
72.	Plug spanner
73.	Hacksaw, metal frame, adjustable type upto 300 mm
74.	Flat file, double cut rough, 200 mm long
75.	Flat file, smooth, double cut, 150 mm long
76.	Half round file, medium, double cut, 150 mm long
77.	Square file, smooth, double cut, 150 mm long
78.	Garage tool kit containing a. Piston ring compressor, 60 mm to 125 mm double bend b. Piston ring expander, 50 mm to 125 mm c. Piston groove cleaner with cutter d. Piston ring file e. Valve lifter (c-type) f. Valve lifter (screw type) g. Brake shoe spring plier
79.	Complete tool kit for car and scooter
80.	Automobile body repair tool kit
81.	Audio visual equipment 1. Overhead projector with film slide adjustment with roll film 2. Video Cassette Player(VCP) 3. Colour TV (if not available in the college)
82.	Fuel injectors of different types (single hole, multi hole, pintax, pintle type) each type minimum one No
83.	Working sectioned model of a single plate clutch
84.	Working sectioned model of a multiplate clutch
85.	Condemned multiple clutch unit with all parts
86.	Sectioned working model of a sliding mesh gear box
87.	Condemned sliding mesh gear box
88.	Sanctioned working model of a constant mesh gear box

89.	Condemned constant mesh gear box
90.	Sectioned working model of synchro-mesh gear box
91.	Condemned synchromesh gear box
92.	Working model of a steering system of an automobile
93.	Sectioned Model of` a. Steering gear box - Rack and pinion type - Worm and wheel type - Worm and sector type - Cam and lever type - Recirculating ball type
94.	Condemned single plate clutch
95.	Sectioned working model of a hydraulic braking system with four wheel cylinder fitted to four brake drums mounted on a tabular frame
96.	Master cylinder assembly
97.	Wheel cylinder with full assembly
98.	Cutout model of differential gear assembly
99.	Rear axles fitted with differential with all the parts assembled
100.	Cutout models of a universal joint
101.	Propeller shafts with universal joints fitted
102.	Sectioned model of a shock absorber - Hydraulic Telescopic type
103.	Telescopic type hydraulic shock absorbers
104.	Engine Analyzer professional work station with all accessories and built in exhaust gas analyzer 1. Switching 115/230 VAC $\pm$ 10% 2. Overall dimensions 61" Height x 39" width 3. Boom height approximately 80" 4. Boom length approximately 54"
105.	Microprocessor wheel balancing machine with all accessories 1. Monophase power supply, 220 Volts, 0.11 KW 2. Balancing accuracy $\pm$ 1 g 3. Rim diameter from 10" to 24" 4. Rim width from 1.5" to 20" 5. Maximum wheel weight 65 kgs.
106.	4 wheel alignment system with all accessories Power supply 50/60 Hz, 350 Watt single-phase motor. Dimensions: 78 cm, Depth 74

	cm, Weight 231 kgs
107.	Diesel smoke Tester with all accessories 1. Power requirement 220/240 Volt, AC 50/60 HZ 2. Operating temperature 2 to 55 degree C 3. Warm-up time less than 15 minutes 4. Response time - less than 5 second to sample reporting 5. Accuracy ± 1%, full scale repeatability + 0.5% 6. Bench Head weight 9.1 kg 7. Effective Cell path length 43 cms
108.	Roller Brake Tester for cars and Vans upto 3 to 5 tons axle road with all accessories Technical Data 1. Electronic strain gauge measuring system 2. Automatic slip cut-out and automatic re-start 3. Automatic stop after leaving the test stand 4. Drive motors-2 x 3 KW 5. Axle load - 3 to 5 T 6. Maximum track - 2200 mm 7. Minimum track - 780 mm 8. Roller diameter - 202 mm 9. Roller friction - 0.9, value for steel and plastic 10. Roller centre distances 400 mm 11. Chassis dimensions H 240 x W 680 x L 2320 mm 12. Test Speed 4.5 Km/h
109.	Suspension Tester (with all accessories) Technical Data 1. System-electric pneumatic 2. Max. shearing force-4000 N 3. Electrical steering-220V- 24 V/3V 4. Max. axle load - 2500 kg 5. Compressed air connections 5-10 bar 6. Ram height - 45 mm 7. Dimensions - 600 mm x 720 mm x 76 mm
110.	Compression Tester-Suitable for 4 to 6 cylinder petrol engine with flexible nose adopters
111.	Compression tester for diesel engines with control knob

112.	Engine performance gauge/vacuum gauge with suitable adopters
113.	Portable exhaust gas analyzer (Electronic types)
114.	Portable exhaust gas analyzer
115.	Spring testing instrument for valve springs, clutch springs and other compression springs 100 kg capacity and upto 105 mm length
116.	Spray painting unit with container 0.5 litre capacity single cylinder - air compressor - reservoir - air pressure gauge with 25' air hose
117.	Decarbonizing kit with various sizes and shapes of wire brushes suitable to operate with a hand drilling gun.
118.	Hydraulic mobile crane 2 tons capacity
119.	Chain pulley block, 1 ton
120.	Engine prop's for servicing (4' x 7/2' x 3')with swivelling stand and rollers
121.	Automatic Transmission with feedback sensors
122.	Pneumatic suspension for Trucks
123.	Creeper roller – Trolley 7/2'x5/4'x3"
1.	Starter test bench to test starter under light run, partial torque, and lock torque condition
2.	Dynamo/Alternator/Regulator test bench for automobile range
3.	Growler and Armature tester with prode testing attachment
4.	Universal puller for auto electrical purpose
5.	Pole shoe screw driver for a starter and Generator (Automotive Range)
6.	Volt Ohm Tester(0-25V),(0-6 ohms)
7.	Volt-Amp Tester(0-30V)(0.20A)
8.	Alternator Regulator Tester for testing electronic Regulator (Automobile Range)
9.	Head light testing equipment (for testing LMV and HMV)
10.	Battery charger (6-36 Volts, 0 to 10 amp.)
11.	Cell tester 12-0-12 watt type
12.	Hydrometers
13.	Neon Timing light (ignition timing) Battery 12V, 6V
14.	Cadmium stick tester (Battery tester)
1.	Crank shaft Grinder
2.	Cylinder Boring machine (Vertical) capacity: 40 x 200 mm Max. Boring depth 610 mm
3.	Honing machine - vertical Beam type

4.	Valve grinding and facing machine
5.	Power operated double column type hydraulic press - 10 ton capacity with motorized pump unit
6.	Lathe machine, centre lathe General type, swing over bed 450 mm, swing in gap 70 mm, admit between centres 555 mm, Power of motor 3 HP, 3 phase, 440 V with accessories
7.	Brake drum skimming lathe
8.	Cylinder head surface grinder Table model
9.	Connecting rod aligner to check a maximum bore of Big end 80 mm and Minimum 40 mm with suitable accessories
10.	Fuel pump calibration machine test F.I.P of all type of vehicles, with accessories
11.	Injector Tester complete with calibrating gauge 0.400 kg/cm
12.	Valve seat cutters set
13.	Cylinder Bore gauge - 35-60, 50-150 mm cylinder dia gauge with Recording spindle of different sizes with all standard accessories with dial accuracy of 0.0001 mm, range 100-250 mm
14.	Injector cleaning unit/kit
15.	Drilling machine with suitable drill stand
16.	Cylinder ridge Remover Three Jaw self expanding type with 0.025 mm divisions, sizes 50 mm to 150 mm
17.	Connecting rod alignment setting equipment
18.	Sleeving and Desleeving tool
19.	Nozzle grinding lapping machine
20.	Nipple forming tool and pipe bending tool - Range Pipe dia from 3mm to 20 mm
21.	Brake shoe – rivetting and derivetting machine
22.	Brake doctor
23.	Car Ambassador, Premier/Maruti/Matador Van (One new and one second hand)
24.	Two wheeler Moped/Scooter/Motor cycle (One new and one second hand)
25.	Four Wheelers - Jeep/Truck Petrol/Diesel (one new and one second hand)
26.	Tractor Escort/Massey Ferguson with trailer (old)
27.	Apparatus for - Verification of law of polygon of forces - Jib Crane - Simply supported Beam for finding reactions - Inclined plane

	- Screw Jack - Work and Worm wheel - Winch Crab(Single)
28.	Various Lamina for determination of CG
29.	Microprocessor based Universal Testing Machine
30.	Torsion Testing Machine (fully computerized)
31.	Impact Testing Machine (Izod and Charpy)
32.	Hardness Testing Machine (Brinell and Rockwell)
33.	Strain Gauges and Measuring Bridges
34.	Spring Testing Machine
35.	Deflection Meters
36.	Extension Meters
37.	Work benches fitted with carpenter vices
38.	Circular saw grinder
39.	Wood cutting band saw-vertical
40.	Bench grinder
41.	Drilling machine
42.	Wood turning lathe
43.	Wood Planner
44.	Tool accessories measuring and marking Instruments
45.	Band saw blade brazing unit
46.	Work benches with vices (4 vices on each bench)
47.	Marking tables with scribers
48.	Surface plates
49.	Bench grinders
50.	Drilling machine
51.	Power Hacksaw
52.	Sheet Bending Machine
53.	Tool kits – taps, dies, drills
54.	Tool kits – chiesels, hammers, files, hacksaw
55.	Accessories like calipers, V blocks, height, gauges steel rules and scribers
56.	Blacksmithy forge (with open hearths, accessories to match the forge)
57.	Wrought iron anvils
58.	Swage blocks
59.	Blower with accessories, motor switch etc

60.	Work benches with vices
61.	Power hammer
62.	Tools and accessories – hammers, swages, tongs, pokers, pullers etc
63.	Electrical welding transformer set with accessories
64.	Gas Cutting Unit
65.	Work benches with vices
66.	Welding generator set
67.	Oxy acetylene welding set with accessories
68.	Acetylene generating set
69.	Electric welder tool kit
70.	Projection welding machine
71.	Brazing equipment with accessories
72.	Soldering irons
73.	Pedestal grinder
74.	Metal spraying gun
75.	Spot welder
76.	TIG welding set
77.	MIG welding set
78.	Seam Welding Machine
79.	Welding Partition Screen
80.	Salt bath oil fired furnace
81.	Salt bath electric resistance furnace
82.	Electric furnace muffle type
83.	Forced circulation tempering furnace
84.	Quenching tank
85.	Work benches
86.	Pyrometers
87.	Pot for bailing out the salt
88.	Metallurgical microscope
89.	Abrasive cut off machine
90.	Wattmeter
91.	Ammeter
92.	Voltmeter
93.	DC shunt motor
94.	Single phase variac

95.	Single phase transformer
96.	Resistive load
97.	Multimeter
98.	CRO
99.	Regulated supply
100.	Signal generator
101.	3-phase inductor motor
102.	3-phase variac
103.	DC shunt generator coupled with motor and starter
104.	Rheostat
105.	Tachometer
106.	Centre lathes
107.	Universal milling machine
108.	Vertical milling machine
109.	Shapers
110.	Planers
111.	Radial drilling machine
112.	Upright drilling machine
113.	Gear Shaper
114.	Universal cylindrical grinder
115.	Hydraulic surface grinder
116.	Tool and Cutter grinder
117.	ANSYS
118.	AutoCAD
119.	Computer – Pentium
120.	Mechanical Desk Top
121.	IDEAS
122.	Digitiser
123.	Plotter
124.	Scanner
125.	Printer (Laser, DMP)


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