Curriculum for

Diploma Programme in

AUTOMOBILE ENGINEERING

For the State of Punjab

(As per NSQF Guidelines)

Prepared by:

Curriculum Development Centre

National Institute of
Technical Teachers Training and Research
Sector 26, Chandigarh - 160 019

November, 2023

STUDY AND EVALUATION SCHEME FOR DIPLOMA IN AUTOMOBILE ENGINEERING
FIRST SEMESTER (As corrected in Jan 2024)

Sr. No.	SUBJECTS	STUDY SCHEME Hours/Week			MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P	Cr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	*English and Communication Skills – I	3	2	4	20	10	30	50	3	20	3	70	100
1.2	*Applied Mathematics – I	4	-	4	50	-	50	50	3	-	-	50	100
1.3	* Applied Physics-I	3	2	4	20	10	30	50	3	20	3	70	100
1.4	* Applied Chemistry	3	2	4	20	10	30	50	3	20	3	70	100
1.5	*Basics of Information Technology	-	2	1	-	40	40	-	-	60	3	60	100
1.6	*Engineering Drawing-I	-	6	3	-	50	50	50	3	-	-	50	100
1.7	*General Workshop Practice – I	-	6	3	-	50	50	-	-	50	3	50	100
1.8	Basics of Automobile Engineering	1	-	1	50	-	50	50	3	-	-	50	100
#Student Centered Activities including Traffic Awareness and Road Safety Camp (I)		-	1	-	-	-	-	-	-	-	-	-	-
	Total	14	21	24	160	170	330	300	-	170	-	470	800

* Common course with other diploma programmes

\# SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and other activities to promote experiential learning.

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Hours/Week			MARKS IN EVALUATION SCHEME								Total Marks of **Int. & Ext.**
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	**P**	**Cr**	**Th**	**Pr**	**Tot**	**Th**	**Hrs**	**Pr**	**Hrs**	**Tot**	
2.1	*English and Communication Skills - II	3	2	4	20	10	30	50	3	20	3	70	100
2.2	*Applied Mathematics – II	3	-	3	50	-	50	50	3	-	-	50	100
2.3	* Applied Physics-II	2	2	3	20	10	30	50	3	20	3	70	100
2.4	*Environmental Studies	2	-	2	50	-	50	50	3	-	-	50	100
2.5	+Applied Mechanics	3	2	4	20	10	30	50	3	20	3	70	100
2.6	*Engineering Drawing-II	-	6	3	-	50	50	50	4	-	-	50	100
2.7	*General Workshop Practice – II	-	6	3	-	50	50	-	-	50	3	50	100
#Student Centred Activities including Traffic Awareness and Road Safety Camp (II)		-	4	-	-	-	-	-	-	-	-	-	-
	Total	13	22	22	160	130	290	300	-	110	-	410	700

* Common Course with other diploma programmes

\+ Common with diploma programmes in Mechanical Engineering, Mechanical Engg.(Production)/Production and Industrial Engg. and Civil Engineering

\# SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and other activities to promote experiential learning.

STUDY AND EVALUATION SCHEME FOR DIPLOMA IN AUTOMOBILE ENGINEERING
THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Hours/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of **Int. & Ext.**
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	**P**	**Cr**	**Th**	**Pr**	**Tot**	**Th**	**Hrs**	**Pr**	**Hrs**	**Tot**	
3.1	Automotive Materials	3	2	4	20	10	30	50	3	20	3	70	100
3.2	Garage Equipment	3	-	3	50	-	50	50	3	-	-	50	100
3.3	Automobile Engine-I	3	2	4	20	10	30	50	3	20	3	70	100
3.4	Automobile Engineering Drawing	-	6	3	-	50	50	50	3	-	-	50	100
3.5	**Workshop Technology – I	3	6	6	10	20	30	50	3	20	3	70	100
3.6	Open Elective (Online/Off line)	2	-	2	50	-	50	50	3	-	-	50	100
# Student Centred Activities including Energy Conservation Awareness Camp; Drug Use and Abuse Awareness Camp		-	5	-	-	-	-	-	-	-	-	-	-
	Total	14	21	22	150	90	240	300	-	60	-	360	600

** Common with diploma programme in Mechanical Engineering, Mechanical Engg.(Production)/Production and Industrial Engineering

SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and other activities to promote experiential learning.

FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Hours/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of **Int. & Ext.**
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	**P**	**Cr**	**Th**	**Pr**	**Tot**	**Th**	**Hrs**	**Pr**	**Hrs**	**Tot**	
4.1	*Generic Skills and Entrepreneurship Development	3	-	3	50	-	50	50	3	-	-	50	100
4.2	Automobile Engine- II	3	2	4	20	10	30	50	3	20	3	70	100
4.3	**Strength of Materials	3	2	4	20	10	30	50	3	20	3	70	100
4.4	Chassis, Body and Transmission - I	3	2	4	20	10	30	50	3	20	3	70	100
4.5	CAD in Automobile Engineering	-	4	2	-	50	50	-	-	50	3	50	100
4.6	**Workshop Technology – II	3	6	6	10	20	30	50	3	20	3	70	100
# Student Centred Activities including Entrepreneurial Awareness camp		-	4	-	-	-	-	-	-	-	-	-	-
	Total	15	20	23	120	100	220	250	-	130	-	380	600

* Common with other diploma programmes

** Common with diploma programmes in Mechanical Engineering, Mechanical Engg.(Production)/Production and Industrial Engineering

\# SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and other activities to promote experiential learning.

Industrial Training - After examination of 4th Semester, the students shall go for training in a relevant industry/field organisation for a minimum period of 6 weeks and shall prepare a diary. It shall be evaluated during 5th semester by his/her teacher for 50 marks. The students shall also prepare a report at the end of training and shall present it in a seminar, which will be evaluated for another 50 marks. This evaluation will be done by HOD and lecturer incharge – training in the presence of one representative from training organizations.

1.1 ENGLISH AND COMMUNICATION SKILLS – I

L	P
3	2

RATIONALE

Communication skills play an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills.

LEARNING OUTCOMES

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

- Pronounce properly.
- Overcome communication barriers.
- Write legibly and effectively.
- Listen in proper prospective.
- Read various genres adopting different reading techniques.
- Converse logically.

DETAILED CONTENTS

1. Basics of Communication (12 hrs)

    1.1 Definition and process of communication
    1.2 Introduction to types of communication - formal and informal, oral and written, verbal and non-verbal
    1.3 Objectives of communication
    1.4 Essentials of communication
    1.5 Introduction to channels of communication - formal (upward, downward, diagonal, horizontal), informal (grapevine, consensus)
    1.6 Barriers to communication

2. Functional Grammar and Vocabulary (12 hrs)

    2.1 Parts of speech
    2.2 Article
    2.3 Tenses
    2.4 Subject verb agreement sentences
    2.5 Active and passive voice
    2.6 Synonyms and antonyms
    2.7 Pair of words
    2.8 Correction of incorrect sentences

3. Listening (04 hrs)

3.1 Meaning of listening
3.2 Listening and hearing
3.3 Importance of listening
3.4 Active listening – Meaning and strategies
3.5 Methods to improve listening skills

4. Speaking (03 hrs)

4.1 Importance
4.2 Methods to improve speaking

5. Reading (12 hrs)

5.1 Meaning
5.2 Techniques of reading: skimming, scanning, intensive and extensive reading
5.3 Comprehension, vocabulary enrichment and grammar exercises based on following readings:

Section - I

- My Struggle for an Education – Booker T. Washington
- Abraham Lincoln's letter to his son's headmaster – Abraham Lincoln
- Gateman's Gift – R.K Narayan
- The Selfish Giant - Oscar Wilde

Section - II

- Say Not, the Struggle Nought Availeth – A H Clough
- Stopping by Woods on a Snowy Evening – Robert Frost
- Where the Mind is Without Fear – Rabindranath Tagore

6. Writing (02 hrs)

6.1 Significance and effectiveness of writing
6.2 Paragraph writing – Word choice, sentence formation and construction of paragraph.

LIST OF PRACTICALS

1. Self and peer introduction
2. Newspaper reading
3. Just a Minute session – extempore
4. Situational conversation and role play
5. Language learning using open source software.

6. Greetings for different occasions
7. Improving pronunciation through tongue twisters.

INSTRUCTIONAL STRATEGY

Open source software should be used to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Revathi, Srinivas, "Communicating Effectively in English, Book-I", Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, "Developing Communication Skills (2nd Edition)", Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, "Oxford Practice Grammar", Oxford University Press, London
4. Chadha, R. K., "Communication Techniques and Skills", Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, "High School English Grammar and Composition", S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, "Communication Skills", Oxford University Press, New Delhi

WEBSITES FOR REFERENCE

1. http://www.mindtools.com/ page 8.html
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	12	12
2	12	12
3	04	6
4	03	3
5	12	15
6	02	2
Total	**45**	**50**

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 binomial theorem, partial fractions, etc. for solving complex engineering problems with exact solutions in a way which involve less computational task. The analytical capabilities will enable the students to solve problems in engineering field.

LEARNING OUTCOMES

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

- Apply Complex Number and its representation for two dimensional designing and related calculations.
- Apply the basic concepts of permutation and combination to find out various ways or arrangements possible for a particular problem.
- Apply binomial theorem to find approximate value of certain expressions and extracting roots of certain expressions.
- Apply basics concepts of partial fractions to simplify the concept of rational expression.
- Solve engineering problems that are in matrix format by applying the basic understanding of matrices and their properties,
- Solve problems related to height, distance, elevation by making use of trigonometry.
- Write the equation of straight line and circle by using coordinate geometry.
- Optimize the utilization of resources by applying concepts of linear programming.

DETAILED CONTENTS

1. Algebra (20 hrs)

   1.1 Complex Numbers: Complex number, representation, modulus and amplitude.

   1.2 Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors excluding repeated factors).

   1.3 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 without proof), first and second binomial approximation with applications to engineering problems.

   1.4 Introduction to Matrices and Determinants – Addition, subtraction and multiplication (upto 3 * 3 matrices), Determinants, simple properties, Crammer Rule.

2. Trigonometry (15 hrs)

   2.1 Introduction to T ratios, 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). T-Ratios of multiple angles, sub-multiple angles (2A, 3A, A/2).

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

3. Co-ordinate Geometry (18 hrs)

   3.1 Cartesian and Polar coordinates (two dimensional), conversion from Cartesian to Polar coordinates and vice-versa

   3.2 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), inter section of two straight lines, concurrency of lines, angle between straight lines.

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

   * Centre and radius
   * Three points lying on it
   * Coordinates of end points of a diameter

4. Operations Research (7 hrs)

4.1 Linear Programming Problems formulations.

4.2 Graphical Method

INSTRUCTIONAL STATREGY

Basic of algebra, trigonometry, coordinate geometry, operations research 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.

RECOMMENDED BOOKS

1. Grewal, BS, "Elementary Engineering Mathematics", Khanna Publishers, New Delhi
2. Sabharwal, SS & Dr Sunita Jain, "Applied Mathematics, Vol. I & II", Eagle Parkashan, Jalandhar
3. Sastry, SS, "Engineering Mathematics, Vol I & II", Prentice Hall of India Pvt. Ltd.,
4. Pal, Srimanta and Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	20	16
2.	15	12
3.	18	16
4	7	06
Total	**60**	**50**

1.3 APPLIED PHYSICS – I

L	P
3	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 engineering and technology are given prominence in the course content.

Note: 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.

LEARNING OUTCOMES

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

- Select units of various physical quantities for use in engineering solutions.
- Represent physical quantities as scalar and vector.
- Use the concepts of force and motion to solve problems.
- Solve problems related to friction, work, power and energy,
- Comprehend properties of matter.
- Comprehend modes of heat transfer.
- Make measurements with accuracy.

DETAILED CONTENTS

1. Units and Dimensions (9 hrs)

    1.1 Physical quantities Units - fundamental and derived units, systems of units (FPS, CGS and SI units)
    1.2 Dimensions and dimensional formulae of physical quantities (area, volume, velocity, acceleration, momentum, force, impulse, work, power, energy, surface tension, stress, strain)
    1.3 Principle of homogeneity of dimensions
    1.4 Dimensional equations and their applications, conversion of units from one system to another for density, force, pressure, work, power, velocity and acceleration. Checking of dimensional equations
    1.5 Limitations of dimensional analysis

2. Force and Motion (10 hrs)

2.1 Scalar and vector quantities – examples, representation of vector, types of vectors
2.2 Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.
2.3 Resolution of Vectors
2.4 Force, Momentum, Statement of Conservation of linear momentum, its applications
2.5 Impulse and its Applications
2.6 Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (Only Formula), Angular momentum and torque (definition only)
2.8 Concept of centripetal and centrifugal forces and their applications with examples such as banking of roads

3. Work, Power and Energy (8 hrs)

3.1 Work: and its units, examples of zero work, positive work and negative work
3.2 Friction: concept, types, laws of limiting friction
3.3 Energy and its units: Kinetic energy and gravitational potential energy with examples and their derivation
3.4 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
3.5 Power and its units, calculation of power in numerical problems

4. Properties of Matter (9 hrs)

4.1 Elasticity: definition of stress and strain, Modulii of elasticity (Only definition, No derivation) , Hooke's law, significance of stress strain curve
4.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure
4.3 Surface tension: concept, its units, angle of contact, applications of surface tension, effect of temperature on surface tension
4.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law

5. Thermometry (9 hrs)

5.1 Difference between heat and temperature
5.2 Modes of transfer of heat (Conduction, convection and radiation with examples)
5.3 Different scales of temperature and their relationship
5.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
5.5 Concept of Co-efficient of thermal conductivity

LIST OF PRACTICALS (to perform minimum 8 experiments)

1. To find volume of solid sphere using a vernier caliper.
2. To find internal diameter and depth of a beaker using a vernier caliper and hence find its volume.
3. To find the diameter of wire using a screw gauge
4. To determine the thickness of glass strip using a spherometer
5. To verify parallelogram law of forces
6. To study conservation of energy of a ball or cylinder rolling down an inclined plane.
7. To determine the atmospheric pressure at a place using Fortin's Barometer
8. To determine the viscosity of glycerin by Stoke's method
9. To determine the coefficient of linear expansion of a metal rod
10. To determine force constant of spring using Hooks law

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XI (Part-I, Part-II)", N.C.E.R.T., Delhi
2. "Applied Physics, Vol. I and Vol. II", TTTI Publications, Tata McGraw Hill, Delhi
3. Verma, HC, "Concepts in Physics Vol. I & II", Bharti Bhawan Ltd. New Delhi
4. "Comprehensive Practical Physics, Vol, I & II", JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
5. Naik, PV, "Engineering Physics", Pearson Education Pvt. Ltd, New Delhi
6. Banwait, RA & R, Dogra, "Applied Physics I & II", Eagle Parkashan, Jalandhar
7. Bhhatacharya, DK & Poonam Tandan, "Engineering Physics", Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	9	10
2.	10	12
3.	8	8
4.	9	10
5.	9	10
Total	**45**	**50**

1.4 APPLIED CHEMISTRY

L	P
3	2

RATIONALE

The use of various chemicals and chemical products in diverse technical and engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable budding diploma holders to develop scientific temper and appreciate importance of chemistry. Hence the subject of Applied Chemistry.

LEARNING OUTCOMES

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

- Interpret both qualitative and quantitative aspects of simple chemical substances.
- Substantiate the laws and principles on which structure of atom is established.
- Understand types of bonds in chemical substance and their influence on the properties of chemical substances.
- Prepare solution of required concentrations.
- Understand qualitatively and quantitatively pH and buffer solutions.
- Significance of pH and buffer solutions and their industrial applications (in the process such as electrolysis, electrochemical machining of materials etc).
- Explain cause and factors adversely affecting natural water quality and remedial measures available for water purification to achieve water quality standards required for domestic, agricultural and industrial applications.
- Appreciate and practice the water conservation techniques.
- Identify and classify the substance based on the electric behavior.
- Realize the laws/principles efficiently used in development of electrochemical cells towards the greener energy.
- Identify most efficient fuel for the engine and engineering applications.
- Understand the elementary idea of polymers and plastics
- Distinguish different type of plastics and their applications.

DETAILED CONTENTS

1. Basic Concept of Chemistry (2 hrs)
   - 1.1 Symbols of elements and valency, writing of chemical formulae of simple compounds.
   - 1.2 Calculation of molecular masses of $CaCO_3$, NaCl, $CuSO_4$, NaOH, $Ca(OH)_2$, H_2SO_4, $C_2H_2O_4$. (Atomic mass of elements should be provided)

2. Atomic Structure and Chemical Bonding (8 hrs)
   - 2.1 Bohr's model of atom (qualitative treatment only).
   - 2.2 Atomic number, atomic mass number isotopes and isobars.
   - 2.3 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,
   - 2.4 Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded).
   - 2.5 Chemical bonding and cause of bonding and types of chemical bonding; Ionic bond (example NaCl) and Covalent bond (sigma (σ) and pi (π) bonds) with examples of H_2, O_2, N_2 and CH_4 Metallic bonding.

3. Solutions (05 hrs)
   - 3.1 Definition of solution, solute and solvent with examples
   - 3.2 Methods to express the concentration of solution- molarity (*M*) and molality (m), mass percentage, volume percentage and mole fraction and related simple numericals.
   - 3.3 Arrhenius concept of acids and bases. pH of solution, simple numericals on pH and industrial applications of pH.
   - 3.4 Definition of buffer solution and types of buffer solutions with examples and industrial applications of buffers solutions.

4. Water (10 hrs)
   - 4.1 Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL^{-1}) and part per million (ppm) and simple numericals.
   - 4.2 Disadvantages caused by the use of hard water in domestic industry and boiler feed water.
   - 4.3 Removal of hardness -Permutit process and Ion-exchange process.
   - 4.4 Drinking water and characteristics of drinking water.
   - 4.5 Natural water sterilization by chlorine and UV radiation and reverse osmosis (elementary idea).

5. Electro Chemistry (6 hrs)

5.1 Electronic concept of oxidation, reduction and redox reactions
5.2 Definition of terms: electrolytes, non-electrolytes with suitable examples
5.3 Faradays laws of electrolysis and simple numerical problems.
5.4 Industrial Application of Electrolysis – Electroplating.
5.5 Application of redox reactions in electrochemical cells (qualitative idea only excluding reactions) - commercial dry cell (Primary) and elementary idea of secondary cell (Only lead storage battery)

6. Chemistry of Fuels and Lubricants (12 hrs)

6.1. Definition of fuel, classification of fuels (primary and secondary), characteristics of good fuel.
6.2 Calorific value-higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.
6.3 Coal - proximate analysis of coal
6.4 Fuel rating – Octane number and Cetane number, fuel-structural influence on Octane and Cetane numbers
6.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas. (preparation/manufacture excluded)
6.6 Definition of Lubricant and characteristics of good lubricant
6.7 Classification of lubricants –liquid lubricants, solid lubricants, semi-solid lubricants with examples
6.8 Properties of lubricant: Physical properties –viscosity and viscosity index, cloud point and pour point, flash point and fire point, oiliness. Chemical properties- Total Acid Value or Number (TAV or TAN), carbon residue, saponification value.

7. Polymers and Plastics (02 hrs)

7.1 Definition of polymer, monomer and degree of polymerization
7.2 Brief introduction of plastics - thermo plastics and thermo setting plastics with suitable examples (PVC, PS, PTFE, Nylon 6, Nylon 66, bakelite) distinction between thermo and thermo setting plastics
7.3 Applications of polymers in industry and daily life
7.4 Introduction to nano materials and nano technology

LIST OF PRACTICALS

1. Preparation of standard solution of oxalic acid.
2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.

3. To determine TDS in given sample of water.
4. To prepare Mohr's salt from ferrous sulfate and ammonium sulfate.
5. Determination of pH of given solution using pH meter.
6. Estimation of total alkalinity of given water sample by titrating it against standard sulfuric acid solution.
7. Gravimetric estimation of moisture in the given coal sample (proximate analysis).
8. Gravimetric estimation of ash content in the given coal sample (proximate analysis).
9. Determination of viscosity of given liquid using Redwood viscometers
10. To construct simple Daniel cell and measure its e.m.f. using voltmeter.
11. To estimate hardness of water using EDTA method.

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.

RECOMMENDED BOOKS

1. Kuricose, J.C. and J. Rajaram, "Chemistry in Engineering", Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Jain, P.C. & Monika Jain, "Engineering Chemistry", Dhanapat Rai Publishing Company, New Delhi.
3. Ahuja, S. C. and G. H. Hugar, "Eagle's Applied Chemistry (I and II)", Eagle Prakashan, Jalandhar.
4. Rao, C N R, "Understanding Chemistry", Universities Press (India) Pvt Ltd., 2011
5. Chopra, H. K. & A. Parmar, "Engineering Chemistry – A Text Book", Narosa Publishing House, New Delhi.
6. Pandey, Dr. Himanshu, "Engineering Chemistry", Goel Publishing House, Meerut, India.

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (Out of 50)
1.	02	03
2.	08	08
3.	05	06
4.	10	12
5.	06	06
6.	12	12
7.	02	03
Total	**45**	**50**

1.5 BASICS OF INFORMATION TECHNOLOGY

L	P
-	2

RATIONALE

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. 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 concept of information technology and its scope; operating a computer; use of various office automation tools using MS Office/Open Office/Libre Office, and internet concepts. This exposure will enable the students to enter their professions with confidence.

LEARNING OUTCOMES

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

- Identify computer hardware components, network components and peripherals.
- Install application and utility software.
- Use word processing software to prepare document.
- Use spreadsheet software to create workbook and automate calculation.
- Use presentation software to create interactive presentation.
- Browse information on the Web.

Note: Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises. There will not be any theory examination.

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Basic Concepts of IT and Its Application

   Information Technology concept and scope, applications of IT.

2. Computer Hardware:

   Block diagram of a computer, components of computer system, CPU, Memory, Input devices; keyboard, Scanner, mouse etc; Output devices; VDU, LCD, Printers etc. Primary and Secondary Memory: RAM, ROM, tracks and sectors, optical disk (CD , DVD & Blue Ray Disk.), USB/Flash Drive, HDD, SSD

3. Software Concepts and Programming:

   System software, Application software, Virtualization software and Utility software, Introduction of Operating System, Installation of Application software, Features of OPEN OFFICE/MS OFFICE(MS word, Excel, PowerPoint).
   Flow chart using algorithm development, Input Output statement, Control structures

4. Internet Concepts:

   Basics of Networking – LAN, WAN, PAN, MAN, and sharing of printers and other resources, Concept of IP addresses, introduction of internet, applications of internet like: e-mail and browsing, concept of search engine and safe searching. Various browsers like Internet explorer/Microsoft Edge, Mozilla Firefox, WWW (World Wide Web), hyperlinks, introduction to Anti-virus.

LIST OF PRACTICAL EXERCISES

1. Given a PC, identify its basic hardware components, network components and peripherals. List their functions .

2. Installation of various application software and utility software.

3 Installation of I/O devices like scanner, printer and plotter.

4. Practice on various features/functions of Windows Operating System..

Word Processing (MS Word/Open Office Writer/Libre Office Writer)

5. Creating/opening, saving and printing a document
6. Editing and formatting a document
7. Setting paragraph and page margins.
8. Adding header, footer and page numbering
9. Creating, inserting and formatting a table.
10. Spell checker, inserting date, time, special symbols, importing graphic images, drawing tools.

Spread Sheet Processing (MS Excel/Open Office Calc/Libre Office Calc)

11 Creating/opening, saving and printing a worksheet.
12 Editing and formatting of worksheets including changing colour, size, font, alignment of text and cell formatting.
13 Using statistical functions like sum, avg, min, max, if, count and countif, lookup.
14 Creating and formatting a chart, Using charts to analyse data. Use of filters.

Presentation Software (MS Power Point/Open Office Impress/Libre Office Impress)

15. Creating, saving, opening and printing a presentation.
16. Different views of a slide.
17. Using slide layout and template.
18. Editing and formatting slides by adding titles, subtitles, text, background, watermark, table, charts, images and sound.
19. Viewing the slide show with slide transition, animation effect, timing and order.

Programming

20. Printing of name 100 times using loop statement.

Internet and its Applications

21. Creating an e mail account. Sending and receiving e-mail.
22. Browsing and down loading of information from internet.
23. Surfing different websites like institute website, State Board PSBTE website, DTE website, NITTTR, Chandigarh website, AICTE website, various search engines like google, bing etc.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office in addition to working on internet. The student should be made capable of working on computers independently.

RECOMMENDED BOOKS

1. Arora, Vipan, “Computer Fundamentals and Information Technology”, Eagle Parkashan, Jalandhar
2. Sinha, PK, “Computer Fundamentals”, BPB Publication, New Delhi
3. Rajaraman V, “Fundamentals of Computer”, Prentice Hall of India Pvt. Ltd., New Delhi
4. Saxena, Sanjay, “MS Office for Everyone”, Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. Leon and Leon, “Fundamentals of Information Technology”, Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

1.6 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:

i) First angle projection is to be followed.
ii) Minimum of 16 sheets to be prepared and at least 3 sheets on AutoCAD.
iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students.

LEARNING OUTCOMES

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

- Identify and use of different grades of pencils and other drafting instruments which are used in engineering field
- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Use different types of scales and their utilization in reading and reproducing drawings of objects and maps.
- Draw 2 - dimensional view of different objects viewed from different angles (orthographic views)
- Draw and interpret complete inner hidden details of an object which are otherwise not visible in normal view
- Generate isometric (3D) drawing from different 2D (orthographic) views/sketches
- Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances
- Use basic commands of AutoCAD.

DETAILED CONTENTS-CUM- PRACTICAL EXERCISES

1. Introduction to Engineering Drawing (03 sheets)

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

   1.2 Different types of lines in Engineering drawing as per BIS specifications

   1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments.

   1.4 Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degree, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4

2. Dimensioning Technique (01 sheet)

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

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

3. Scales (02 sheets)

   3.1 Scales –their needs and importance (theoretical instructions), type of scales, definition of R.F. and length of scale

   3.2 Drawing of plain and diagonal scales

4. Orthographic Projections (06 sheets)

   4.1 Theory of orthographic projections (Elaborate theoretical instructions)

   4.2 Projection of Points in different quadrant

   4.3 Projection of Straight Line (1^{st} and 3^{rd} angle)
   - 4.3.1. Line parallel to both the planes
   - 4.3.2. Line perpendicular to any one of the reference plane
   - 4.3.3. Line inclined to any one of the reference plane.

4.4 Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only

4.5 Three views of orthographic projection of different objects. (At least one sheet in 3rd angle)

4.6 Identification of surfaces

5. Sections (02 sheets)

5.1 Importance and salient features

5.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.

5.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections

5.4 Orthographic sectional views of different objects.

6. Isometric Views (02 sheets)

6.1 Fundamentals of isometric projections and isometric scale.

6.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.

7. Common Symbols and Conventions used in Engineering (02 sheets)

7.1 Civil Engineering sanitary fitting symbols

7.2 Electrical fitting symbols for domestic interior installations

*8. Introduction to Computer Aided Drafting (03 sheets)

Basic introduction and operational instructions of various commands in Computer Aided Drafting. At least three 2 D drawings using Computer Aided Drafting of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

* **Computer aided drawing will be evaluated internally by sessional marks and not by final theory paper.**

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. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

RECOMMENDED BOOKS

1. Singh, Surjit, “A Text Book of Engineering Drawing”, Dhanpat Rai & Co., Delhi
2. Gill, PS, “Engineering Drawing”, SK Kataria & Sons, New Delhi
3. Bhatt, ND, “Elementary Engineering Drawing in First Angle Projection”, Charotar Publishing House Pvt. Ltd., Anand
4. Layall, JS, “Engineering Drawing I & II”, Eagle Parkashan, Jalandhar
5. Goel, DK, “Engineering Drawing I”, GBD Publication.

1.7 GENERAL 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 practical. General workshop practical included in the curriculum in order to provide hands-on practical knowledge of different tools and basic manufacturing processes. Basic knowledge of workshop technology and practical in various workshops develop the attitude of team working, safety awareness and development of right attitude. This subject provides miniature industrial environment in the educational institute.

LEARNING OUTCOMES

After completing the course the students will be able to:

- Identify shop wise tools and equipment, their types, specifications and use with proficiency.
- Identify different types of materials, their uses and to maintain tools, equipment etc.
- Use and take measurements with the help of basic measuring tools/instrument.
- Select proper tools for a particular operation and use hand tools in different workshops with predefined outcome.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same according to drawing.
- Operate various tools and equipment in different workshops with predefined outcome, performance, standards.
- Follow the safety procedures and precautionary measures in different workshop with zero accidents.

DETAILED CONTENTS-CUM- PRACTICAL EXERCISES

Note: The students are supposed to come in proper workshop uniform 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 workshops will be explained for conduct of practical. The students should prepare sketches of various tools/jobs sequence of operations etc. in their practical notebook.

The following shops are included in the syllabus:

1. Welding Shop – I
2. Fitting Shop – I
3. Sheet Metal Shop – I
4. Electric Shop-I
5. Carpentry Shop – I
6. Smithy Shop – I or Additive Manufacturing Shop- I

1. WELDING SHOP – I

a. Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction and importance of welding as compared to other material joining processes. Classification of welding processes. Specifications and type of welding machines, welding parameters, welding methods, welding joints and welding positions. Classification and coding of electrodes and functions of electrode coating ingredients.

b. Demonstration of hand tools, arc welding machines, equipment and materials to be welded.

1.3 Jobs to be prepared:

Job I	Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat) and Practice of depositing beads at different current levels. (Minimum 4 beads on M.S. flat at four different setting of current level).
Job II	Making a lap joint using arc welding (SMAW) on MS Flat.
Job III	Making a butt joint using arc welding (SMAW) on MS Flat. (100 mm long).
Job IV	Making a T shape Joint using arc welding (SMAW) on M.S. Flat (100mm x 6 mm).

2. FITTING SHOP – I

2.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction, functions, classification, specification and use of various types of holding, cutting, marking and measuring tools used in fitting shop like-Bench vice, V block, C clamp, Ball peen hammer, scriber, punches, files, hacksaw, surface plate, try square, calipers, steel rule, Vernier calliper, Micrometre and Vernier height gauge etc. Identification of materials like-Iron, Copper, Stainless Steel, Aluminium etc.), Identification of various steel sections like-flat, angle, channel, bar etc.). Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).

2.2 Demonstration of various types of holding, cutting, marking and measuring tools used in fitting shop.

2.3 Jobs to be prepared:

Job I To make a rectangular job by performing the operations: Sawing, Marking, filing on MS work piece (75 x 50 x 6 mm) by making sides at 90 degree and surface flatness at 180 degrees and to maintain dimensions within an accuracy of ± 0 .25 mm.

Job II To make a job by performing the operations: Sawing, Marking, corner circular/radius filing on MS work piece (75 x 50 x 6 mm) by measuring dimensions with the help of Vernier Calipers within the tolerance of ± 0 1mm.

Job III To Make 'V' type cut-out profile from a square piece of MS flat using hand hacksaw, filing, marking and measuring operations.

3. SHEET METAL SHOP – I

3.1. Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction and functions of various types of tools used in sheet metal shop: - snips, hand shearing, measuring tools, marking tools, striking tools and bending tools including types of stakes. Introduction and importance to different types of joints and fasteners used in sheet metal work. Introduction and purpose of different metals used in sheet-metal work-black iron, galvanized iron, aluminium and stainless steel. Introduction of different types of Rivets, types of riveted joints, advantages, disadvantages and applications.

3.2 Demonstration of various types of holding, cutting, marking and bending tools used in fitting shop. demonstration of various raw materials used in sheet metal shop e.g. black-iron sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.

3.3 Jobs to be prepared:

Job I Shearing and bending practice on a sheet using hand shears/snips and stakes.

Job II To fabricate different types of sheet metal joint such as lap joint-single seam/double seam.

Job III To fabricate riveted lap joint (chain or zig zag type).

Job IV To fabricate single cover plate chain type, zig-zag type and single rivetted butt Joint.

4. ELECTRIC SHOP - I

4.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction, functions and specifications of different

types of tools, wires, cables, switches, fuses, cleats, clamps, allied items, and accessories used in Electric shop. Introduction to battery charger and its functioning. Introduction to common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Introduction to lead acid battery and nickel cadmium battery.

4.2 Demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, fuses, cleats, clamps and allied items, tools and accessories. Demonstration of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Demonstration of lead acid battery and nickel cadmium battery.

4.3 Job Practice:

Job I Identification of phase, neutral, earth wires for connection to domestic electrical appliances and their connections to three pin plugs.

Job II Practice in making series and parallel circuit. Make one lamp control by one switch circuit.

Job III Practice on house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping, conduit and concealed wiring.

Job IV Installation of battery and connecting two or three batteries in series and parallel.

Job V Charging a battery and testing with hydrometer and cell tester

5. CARPENTRY SHOP – I

5.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to wood, timber their properties, uses & defects and their joints. Seasoning of wood and its advantages. Introduction, specifications and function of various types of tools used in carpentry (such as different types of Saws, C-Clamp, Chisels, Carpenter's vice, Mallets, Marking gauges, Scriber, Try-square, Steel tape, Wooden plane, Metallic Jack plane, Rulers) by segregating as cutting tools, supporting tools, holding tools, measuring tools etc. Types of wooden joints. Techniques/method of sharpening of jack plane cutter/blade.

5.2 Demonstration of wood/timber, seasoning, various types of tools used in carpentry shop. Types of wooden joints.

5.3 Jobs to be Prepared :

Job 1 To make a rectangular wooden piece involving operations like-planing, marking, sawing and measuring.

Job II Iron jack plane blade/cutter sharpening and Chisel sharpening practice.

Job III To make a Half Lap Joint (cross, L or T shape – any one)
Job IV To make a Mortise and Tenon joint (T- shape Joint)

6. SMITHY SHOP – I

6.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to Smithy shop, different types of Hearths, its purpose, specifications, uses, types of various tools and equipment used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools etc. Types of fuel used and maximum temperature obtained, types of raw materials used in Smithy Shop , uses of Fire Bricks and Clays in Forging workshop.

6.3 Demonstration of different fuels used and maximum temperature obtained. Use of fire brick and clay in forging/ smithy shop. Practice of firing of hearth/Furnace, Temperature Control of Fire. Demonstration of different basic Smithy/Forging operations such as Cutting, Upsetting, Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting. Demonstration of Simple Heat treatment processes like Tempering, Normalizing Hardening etc

6.3 Jobs to be prepared:
Job I Making a job of square shape from a M.S. rod by forging method.

Job II Making a square shape L hook from M.S. rod.

Job III Making a ring from MS rod by cold or hot forging process

Job IV Making a job using drawing down operation on round or flat section.

6. ADDITIVE MANUFACTURING SHOP - I

6.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to digital design, Computer Aided Drafting (2D drawing) and Computer Aided Design (3D modelling), various CAD packages, basic 2D and 3D commands, basic geometrical shapes (both regular and irregular) etc. Introduction to Additive Manufacturing, identification of different types of materials used, applications and advantages. Identification of different types of geometrical shapes: regular shapes like sphere, prisms, pyramids, solids of revolution, irregular shapes like I section, L section, C section and T section etc.

6.2 Demonstration of 3D CAD package including software interphase, basic commands for drawing, editing, modelling etc., fabrication of 3D models, saving in .PRT file, conversion to .STL file, error identification and its rectification, working of 3D printer, 3D printing of simple components.

6.3 Jobs to be performed

Job I: 3D modelling of basic right regular geometrical shapes:

Prisms: Triangular, square. Rectangular, pentagonal and hexagonal

Pyramids: Triangular, square. Rectangular, pentagonal and hexagonal

Job II: 3D modelling of solids of revolution: Sphere, cylinder, cone and torus

Job III: 3D modelling of special shapes like I section, L section, C section and T section

Job IV: 3D modelling of machined parts using various 3D commands.

Note :

1. Workshop instructors will guide and help the students throughout the practical class in order to explain and complete the job according to syllabus and for providing necessary facilities to the students during performance of practical by observing the safety precautions

2. The Workshop Superintendent or Foreman Instructor or Foreman will demonstrate and deliver the theoretical instructions with regard to introduction, functions, classification and specification of tools, instruments, equipment, apparatus etc. of all the topics covered in the syllabus.

3. The Workshop Superintendent or Foreman Instructor will also conduct the mid-term test and final practical exam of this subject.

RECOMMENDED BOOKS

1. Singh, Swaran, “Workshop Practice”, S. K. Kataria and Sons, New Delhi.
2. Bawa, H.S., “Workshop Practice”, Tata McGraw Hill Publishers, New Delhi.
3. Hajra, SK, “Workshop Technology I, II, III”, Choudhary and AK Choudhary Media Promoters and Publishers Pvt. Ltd. Mumbai.
4. Manchanda, “Workshop Technology Vol. I, II, III”, India Publishing House, Jalandhar.
5. Raghuwanshi, B.S., “ Workshop Technology”, Dhanpat Rai and Co., New Delhi

1.8 BASICS OF AUTOMOBILE ENGINEERING

L	P
1	-

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 deals with basic introduction of Automobile Engineering with brief introduction of its various parts.

LEARNING OUTCOMES

On completion of the course, a learner will be able to:

- Explain the different types of engine on the basis of fuel and stroke.
- Identify various engine components
- Explain the function of various systems in Automobile engineering.
- Comprehend the basic layout of vehicle.
- Name the brand and models of different manufacturer of vehicles.

DETAILED CONTENTS

1. Introduction (3 Hours)
   Types of engines - internal and external combustion Engines, Classification of engines as per stroke and fuel, Difference between petrol and diesel engine.

2. Engine Components (3 Hours)
   Name of engine components with their material & functions.

3. Automobile Systems (3 Hours)
   Brief introduction of various systems required in vehicle like cooling system, lubrication system, suspension system, ignition system ,fuel system.

4. Transmission System (3 Hours)
   Layout of Transmission system with function of clutch, gearbox, propeller shaft and differential

5. Vehicle Manufacturers (3 Hours)
   List of the top manufacturer companies of two wheelers, cars and jeeps with their models.

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.

RECOMMENDED BOOKS

1. R.B. Gupta, "Automobile Engineering", Satya Parkashan, New Delhi, 2018.
2. Dr. Kirpal Singh,"Automobile Engineering", Vol. I and II Standard Publishers, Delhi.
3. A.K. Babu and Ajit Pal Singh, "Automobile Engineering", S. Chand & Company, New Delhi, 2014.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	3	10
2	3	10
3	3	10
4	3	10
5	3	10
Total	**15**	**50**

TRAFFIC AWARENESS & ROAD SAFETY CAMP (I)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety By obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of Distt. Traffic police. There will be no exam for this camp.

1. Road safety Scenario
2. School bus and traffic management
3. Awareness of Traffic Signs
4. Speeding Limit
5. Always Wear your Shields
6. Overtaking
7. Awareness through Hoardings
8. Walking & Safe cycling

2.1 ENGLISH AND COMMUNICATION SKILLS - II

L	P
3	2

RATIONALE

Communication skills play an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills.

LEARNING OUTCOMES

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

- Make proper oral presentations.
- Speak confidently.
- Debate properly.
- Write accurate official/business letters.
- Respond to telephone calls effectively.
- Overcome communication barriers.

DETAILED CONTENTS

1. Functional Grammar and Vocabulary (12 hrs)

   Theory and Practical exercises on following:
   - 1.1 One word substitution
   - 1.2 Functional Grammar and Vocabulary
   - 1.3 Prefixes and Suffixes
   - 1.4 Punctuation
   - 1.5 Narration
   - 1.6 Idioms and Phrases

2. Reading (9 hrs)

   Comprehension, Vocabulary enrichment and grammar exercises based on the following readings:

   Section-I

   - The Last Leaf - O' Henry
   - Sparrows - K A Abbas
   - The Postmaster - Rabindra Nath Tagore

Section-II

- Night of the Scorpion - Nissim Ezekiel
- All the World is a Stage - William Shakespeare
- Success – Emily Dickenson
- Daffodils – William Wordsworth

3. Writing (24 hrs)

3.1 Writing Resume and Cover letter
3.2 Correspondence: Business and Official
3.3 Report Writing – Introduction and features of good report.
3.4 Press Release
3.5 Memos and Circulars
3.6 Notices (lost, found, and auction)
3.7 Agenda and Minutes of Meetings
3.8 Filling-up different forms such as bank form and on-line form for placement etc.
3.9 Precis Writing
3.10 E mail writing

LIST OF PRACTICALS

1. Group discussion on some current topic of interest.
2. Small speech using voice modulation.
3. Debate
4. Manners and Etiquette
5. Power point presentation
6. Telephonic conversation: General etiquette for making and receiving calls.
7. Mock interviews

INSTRUCTIONAL STRATEGY

Open source software should be used to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Revathi, Srinivas, "Communicating Effectively in English, Book-I", Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, "Developing Communication Skills (2nd Edition)", Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, "Oxford Practice Grammar", Oxford University Press, London

4. Chadha, R. K., “Communication Techniques and Skills”, Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, “High School English Grammar and Composition”, S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, “Communication Skills”, Oxford University Press, New Delhi

WEBSITES FOR REFERENCE

1. http://www.mindtools.com/ page 8.html
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	12	12
2	9	12
3	24	26
Total	**45**	**50**

2.2 APPLIED MATHEMATICS – II

L	P
3	-

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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Apply differential calculus to solve max/min and related rate measure problems.
- Apply concepts of definite integrals to calculate the area of a curve bounded by axes.
- Evaluate complex integrals in a simpler way by applying definite integral.
- Solve engineering problems by making use of ordinary differential equations.

DETAILED CONTENTS

1. Differential Calculus (18 hrs)

1.1 Definition of function; Introduction to limit and continuity (definition only).

1.2 Standard differentiation of algebraic, trigonometric, inverse trigonometric functions, logarithmic function and exponential function.

1.3 Differentiation of sum, product and quotient of functions, Differentiation of function of a function, differentiation of implicit functions and parametric functions.

1.4 Logarithmic differentiation and successive differentiation (excluding nth order).

1.5 Application of differential calculus in:

(a) Rate Measures

(b) Maxima and minima (single variable functions) using second order derivative only

(c) Equation of tangent and normal to a curve (for explicit functions only)

2. Integral Calculus (22 hrs)

2.1 Indefinite integrals, Integration as inverse operation of differentiation with simple examples.

2.2 Standard integrals and related simple problems

2.3 Simple integration by substitution, by parts and by partial fractions (for linear factors only)

2.4 Evaluation of definite integrals (simple problems)

Evaluation of $\int_0^{\pi/2} \text{Sin}^n x.\, dx$, $\int_0^{\pi/2} \text{Cos}^n x\, dx$, $\int_0^{\pi/2} \text{Sin}^m x\ \text{Cos}^n x\, dx$

using formulae without proof (m and n being positive integers only).

2.5 Applications of integration for evaluation of area bounded by a curve and axes (Simple problems).

3. Differential Equations (5 hrs)

3.1 Definition, order, degree of ordinary differential equations.

3.2 Formation of differential equation (up to 2^{nd} order). Solution of Differential equations with Variable separation and Linear Differential equations.

INSTRUCTIONAL STATREGY

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.

RECOMMENDED BOOKS

1. Grewal, BS, "Elementary Engineering Mathematics", Khanna Publishers, New Delhi
2. Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar
3. Sabharwal, SS & Dr Sunita Jain, "Applied Mathematics, Vol. I & II", Eagle Parkashan, Jalandhar

4. Engineering Mathematics, Vol I, II & III by V Sundaram et al, Vikas Publishing House (P) Ltd., New Delhi

5. Sastry, SS, "Engineering Mathematics, Vol I & II", Prentice Hall of India Pvt. Ltd.,

6. Pal, Srimanta and Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	18	20
2	22	25
3	5	05
Total	**45**	**50**

2.3 APPLIED PHYSICS – II

L	P
2	2

RATIONALE

Applied physics includes the study of a large number of diverse topics related to things that go in the world around us. It aims to give an understanding of this world both by observation and prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;

- Apply the concept of wave motion
- Illustrate laws of reflection and refraction of light.
- Comprehend the phenomenon related to electrostatics
- Comprehend the terms and laws related to electricity and magnetism.
- Make use of laser for engineering applications.

DETAILED CONTENTS

1. Wave motion and its Applications (6 hrs)

   1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length and its application
   1.2 Free, forced and resonant vibrations with examples
   1.3 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications
   1.4 Ultrasonics – Introduction and applications.

2. Optics (6 hrs)

   2.1 Laws of reflection and refraction, refractive index, lens formula for thin lenses, power of lens, magnification
   2.2 Total internal reflection and its applications, Critical angle and conditions for total internal reflection
   2.3 Simple and compound microscope, astronomical telescope in normal adjustment, magnifying power (Only formula).

3. Electrostatics (6 hrs)

3.1 Coulombs law, unit of charge,
3.2 Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference
3.3 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor (No derivation), Series and parallel combination of capacitors (numericals)
3.4 Dielectric and its effect on capacitance, dielectric break down

4. Electricity and Magnetism (9 hrs)

4.1 Electric Current and its Unit, Direct and alternating current,
4.2 Resistance and its Units, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance, Superconductivity (concept only)
4.3 Ohm's law and its verification
4.4 Kirchhoff's laws, Wheatstone bridge principle
4.5 Heating effect of current, Electric power, Electric energy and its units (related numerical problems)
4.6 Introduction to magnetism, Types of magnetic materials. Dia, para and ferromagnetic materials with their properties,
4.7 Magnetic field and its units, magnetic lines of force, magnetic flux and their units
4.8 Concept of electromagnetic induction, Faraday's Laws and Lenz's law, Galvanometer and its use.

5. Modern Physics (3 hrs)

5.1 Lasers: its characteristics, spontaneous and stimulated emission, population inversion; Principle, construction and working of Ruby laser, engineering applications of lasers.

LIST OF PRACTICALS (To perform minimum 8 experiments)

1. To find the time period of a simple pendulum
2. To determine and verify the time period of cantilever
3. To verify laws of reflection from a plane mirror.
4. To find the focal length of convex lens by parallax method.
5. To determine the magnifying power of an astronomical telescope
6. To verify ohm's laws by drawing a graph between voltage and current.
7. To verify laws of resistances in series and parallel combination.
8. To find resistance of galvanometer by half deflection method
9. To measure very low resistance and very high resistances using Slide Wire bridge
10. Use of CRO in plotting AC and DC waveforms.
11. To find wave length of the laser beam.

INSTRUCTIONAL STATREGY

Teacher may use various instructional media like models, charts and graphs while imparting instructions. The field application should be made clear before teaching the basics to develop proper understanding of the physical phenomenon**.** Use of demonstration can make the subject interesting and develop scientific temper in the students.

RECOMMENDED BOOKS

1. Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. Practical Physics by C. L. Arora, S Chand Publications
4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (hrs)	Marks Allotted (Out of 50)
1	06	10
2	06	10
3	06	10
4	09	15
5	03	05
Total	**30**	**50**

2.4 ENVIRONMENTAL STUDIES

L	P
2	-

RATIONALE

Engineering activities require the use of natural resources which results in wide-ranging adverse effects on the environment. Natural replenishment of these recourses is practically impossible. This necessities that all technicians should know about the basics of ecology, environment and its functions, environmental pollution and management and environmental legislation which will enable them to accomplish their professional work with environmental compatibility. Hence this subject.

LEARNING OUTCOMES

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

- Comprehend the importance of ecosystem and environment.
- Demonstrate interdisciplinary nature of environmental issues.
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abetment of environmental pollutions.
- Compute the impact of human activities on the environment.
- Understand purpose of environmental legislation acts.
- Define energy management, energy conservation and energy efficiency
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Adopt cleaner productive technologies
- Identify the role of non-conventional energy resources in environmental protection.

DETAILED CONTENTS

1. Introduction: (4 hrs)
   Basics of ecology, eco system and environment. Review of carbon, nitrogen, sulphur and water cycle)

2. Conservation of land reforms: (3 hrs)
   Desertification, Causes, effects and prevention. rain water harvesting, maintenance of ground water, deforestation – its effects and control measures

3. Environmental Pollution: (10 hrs)
   Sources of pollution - natural and man made, causes, effects and control measures of pollution (air, water, noise, soil and radioactive). Concept of BOD, COD and AQI, Prevention of Pollution- Introduction to Cleaner Production Technologies, Waste Minimization Techniques, Concept of Zero Discharge, Impact of Energy

Usage on Environment: Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain.

4. Solid Waste management (3 hrs)
Classification of refuse material, sources, effects and control measures. Introduction to E-waste Management

5. Environmental Legislation (4 hrs)
Introduction to Water (prevention and control of pollution) Act, Air (Prevention and Control of Pollution) Act and Environmental Protection Act, Role and Function of State Pollution Control Board, Introduction to Energy Conservation Act & its importance, Concept of Environmental Impact Assessment (EIA)

6. Energy Conservation and Sustainable Development (6 hrs)
Introduction to Energy Management, Energy Conservation, Energy efficiency and its need. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio mass energy, hydro energy) in environmental protection. Sustainable development, Concept of Green building and eco friendly materials.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits etc. may also be organized.

RECOMMENDED BOOKS

1. Sharma, BR, "Environmental and Pollution Awareness", Satya Prakashan, New Delhi.
2. Khitoliya, Dr. RK, "Environmental Pollution", S Chand Publishing, New Delhi.
3. Deswal and Deswal, "Environmental Science", Dhanpat Rai and Co. (P) Ltd. Delhi.
4. Bharucha, Erach, "Environmental Studies", University Press (India) Private Ltd., Hyderabad.
5. Dhamija, Suresh K, "Environmental Engineering and Management", SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	06
2	3	05
3	10	16
4	3	05
5	4	06
6	6	12
Total	**30**	**50**

2.5 APPLIED MECHANICS

L	P
3	2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, laws of motion, moment, friction, centre of gravity, 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.

LEARNING OUTCOMES

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

- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Solve problems by using principle of moment.
- Calculate the co-efficient of friction for different types of surfaces.
- 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

DETAILED CONTENTS

1. Introduction (2 hrs)

   1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.

   1,2 Concept of rigid body, scalar and vector quantities

2. Laws of forces (10 hrs)

   2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, contact and non contact forces, effects of force, characteristics of a force

   2.2 Newton’s laws of motion, Newton’s laws of gravitation, Difference between mass and weight

   2.3 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position

2.4 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components

2.5 Free body diagram

2.6 Equilibrant force and its determination

2.7 Lami's theorem (concept only)

[Simple problems on above topics]

3. Moment (9 hrs)

3.1 Concept of moment

3.2 Moment of a force and units of moment

3.3 Varignon's theorem (definition only)

3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)

3.5 Parallel forces (like and unlike parallel force), calculating their resultant

3.6 Concept of couple, its properties and effects

3.7 General conditions of equilibrium of bodies under coplanar forces

3.8 Position of resultant force by moment

[Simple problems on the above topics]

4. Friction (9 hrs)

4.1 Definition and concept of friction, types of friction, force of friction

4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction

4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.

4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:

a) Acting along the inclined plane Horizontally
b) At some angle with the inclined plane

5. Centre of Gravity (6 hrs)

5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies

5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion

5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed

[Simple problems on the above topics]

6. Simple Machines (9 hrs)

6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of - a machine and their relationship, law of machines

6.2. Simple and compound machine (Examples)

6.3. Definition of ideal machine, reversible and self locking machine

6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency

6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency

6.6. 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

[Simple problems on the above topics]

LIST OF PRACTICALS

1. Verification of the polygon law of forces using gravesend apparatus.
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4 To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.

7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. Ramamurtham, S, "A Text Book of Applied Mechanics", Dhanpat Rai Publishing Co. Ltd.
2. Khurmi, RK, "A Text Book of Engineering Mechanics (Applied Mechanics)", S Chand and Co. Ltd., New Delhi.
3. Rajput, RK, "A Text Book of Applied Mechanics", Laxmi Publications, New Delhi.
4. Singh, Birinder, "Text Book of Applied Mechanics", Kaption Publishing House, New Delhi.
5. Upadhya, AK, "Text Book of Applied Mechanics", SK Kataria & Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	2	2
2	10	12
3	9	10
4	9	10
5	6	6
6	9	10
Total	**45**	**50**

2.6 ENGINEERING DRAWING - II

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 16 sheets to be prepared and at least 3 sheets in AutoCAD.
3) Instructions relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students.
4) Continuous evaluation be done by the teachers for exercises/work done on CAD software. For this proper record may be maintained for its inclusion in the internal assessment.

LEARNING OUTCOMES

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

- Draw and learn different types of wooden joints used in furniture.
- Draw the assembly from part details of objects.
- Identify and draw different types of screw threads used in various machines and assemblies as per domestic and international standards.
- Draw different types of nuts, bolts and washers.
- Draw various locking devices and foundation bolts.
- Draw different section of various types of keys and cotter joints.
- Draw various riveted joints.
- Draw various types of couplings used in power transmission.
- Prepare drawing of given joints/couplings using AutoCAD.

DETAILED CONTENTS-CUM- PRACTICAL EXERCISES

1. Detail and Assembly Drawing (02 sheets)

    1.1 Principle and utility of detail and assembly drawings
    1.2 Wooden joints i.e. corner mortise and tenon joint, Tee halving joint, Mitre faced corner joint, Tee bridle joint, Crossed wooden joint, Cogged joint, Dovetail joint, Through Mortise and Tenon joint, furniture drawing - freehand and with the help of drawing instruments.

2. Screw Threads (03 sheets)

2.1 Thread Terms and Nomenclature

2.1.1 Types of threads-External and Internal threads, Right and Left hand threads (Actual and Conventional representation), single and multiple start threads.

2.1.2 Different Forms of screw threads-V threads (B.S.W threads, B.A thread, American National and Metric thread), Square threads (square, Acme, Buttress and Knuckle thread)

3. Nuts and Bolts (02 sheets)

3.1 Different views of hexagonal and square nuts. Square and hexagonal headed bolt

3.2 Assembly of Hexagonal headed bolt and Hexagonal nut with washer.

3.3 Assembly of square headed bolt with hexagonal and with washer.

4. Locking Devices (02 sheets)

4.1 Different types of locking devices-Lock nut, castle nut, split pin nut, locking plate, slotted nut and spring washer.

4.2 Foundations bolts-Rag bolt, Lewis bolt, curved bolt and eye bolt.

4.3 Drawing of various types of studs

5. Keys and Cotters (03 sheets)

5.1 Various types of keys and cotters - their practical application, drawings of various keys and cotters showing keys and cotters in position

5.2 Various types of joints

- Spigot and socket joint
- Gib and cotter joint
- Knuckle joint

6. Rivets and Riveted Joints (04 sheets)

6.1 Types of general purpose-rivets heads

6.2 Caulking and fullering of riveted joints

6.3 Types of riveted joints

(i) Lap joint-Single riveted, double riveted (chain and zig-zag type)

(ii) Single riveted, Single cover plate butt joint

(iii) Single riveted, double cover plate butt joint

(iv) Double riveted, double cover plate butt joint(chain and zig-zag type)

7. Couplings (02 sheets)

7.1 Introduction to coupling, their use and types
7.2 Flange coupling (protected)
7.3 Flexible Coupling

*8. Use of CAD software (03 sheets)

Draw any three joints/coupling using CAD software from the following:
i) Sleeve and cotter joint
ii) Knuckle joint
iii) Spigot and socket joint
iv) Gib and cotter joint
v) Flange coupling
vi) Muff coupling

*** CAD drawings will be evaluated internally by sessional marks and not by final theory paper.**

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. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

RECOMMENDED BOOKS

1. Singh, Surjit, "A Text Book of Engineering Drawing", Dhanpat Rai & Co., Delhi
2. Gill, PS, "Engineering Drawing", SK Kataria & Sons, New Delhi
3. Bhatt, ND, "Elementary Engineering Drawing in First Angle Projection", Charotar Publishing House Pvt. Ltd., Anand
4. Layall, JS, "Engineering Drawing I & II", Eagle Parkashan, Jalandhar
5. Goel, DK, "Engineering Drawing I", GBD Publication.
6. AutoCAD 2010: For Engineers & Designers by Prof. Sham Tickoo and D. Sarvanan; Wiley India Pvt. Ltd., Delhi.

2.7 GENERAL WORKSHOP PRACTICE - II

L	P
-	6

RATIONALE

Psychomotor skills are mastered through practice, an opportunity therefore, has been extended to students through this course to refine their skills in different trades. The basic skills developed during first semester will be refined during this course by doing higher order skills jobs including machining. In addition to developing general manual and machining skills in the students, the objective of development of sense of dignity of labour, precision, safety at work places, team working and right attitude among the students will also be met.

LEARNING OUTCOMES

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

- Select materials, sequence of operations, select tools to make a given job based on interpretation of drawing as per given specification with close tolerances using at least the resources of three shops.
- Prepare a job as per given specifications for a given shop.
- Specify and read/understand specifications of different types of tools, equipment and machines used in various shops.
- Inspect visually to identify various types of defects in different type of materials.
- Analyze a given job and identify various operations required to make it.
- Follow safety procedures and measures.
- Maintain good housekeeping practices.

DETAILED CONTENTS-CUM- PRACTICAL EXERCISES

Note: The students are supposed to come in proper workshop uniform 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 workshops will be explained for conduct of practical. The students should prepare sketches of various tools/jobs sequence of operations etc. in their practical notebook.

The following shops are included in the syllabus.

1 Welding Shop – II
2 Fitting Shop – II
3 Sheet Metal Shop – II
4 Electric Shop -II
5 Carpentry Shop – II
6 Smithy Shop – II or Additive Manufacturing Shop - II

1. WELDING SHOP - II

1.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to gas welding (Oxy-acetylene welding, Air acetylene welding, Oxy-hydrogen welding). Introduction to gas welding equipment: - Gas welding torch, cylinders, Blow pipe and Pressure regulators etc. Types of gas welding flames. Functions of filler materials and fluxes. Introduction to soldering and brazing. Difference between welding, soldering and brazing. Introduction to resistance welding.

1.2 Demonstration of Gas welding equipment, TIG, MIG and spot-welding machines. Demonstration of brazing and soldering.

1.3 Jobs to be prepared:

Job I	Making a lap joint on 75 mm × 35 mm × 3mm M.S. plate using gas welding (Oxy-acetylene).
Job II	Making a butt joint on 75mm×35mm×3mm M.S. flat using gas welding (Oxy-acetylene).
Job III	Making a square pyramid from M.S. rod by welding (Oxy-acetylene Gas welding).
Job IV	Making a simple job on spot welding machine.

2. FITTING SHOP – II

2.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction, function and specification of different types of cutting tools (chisels and scrapers etc.), tightening tools (pliers, screw driver, wrenches etc.) types of drill and drilling machines used in fitting shop. Classification of files: according to cut, grade, and shape. Measuring devices (Fillet/radius gauge, screw pitch gauge, wire gauge, telescopic gauge), Vernier height gauge. Surface gauge and universal surface gauge. Description of drill, reamer, tap and die set. Selection of dies for threading, selection of drill size for taping.

2.2 Demonstration on use of various measuring tools (Vernier caliper, Vernier height gauge and outside and inside micrometers etc.), finding least count and checking of zero error. Demonstration of various types of drills, taps and dies.

2.3 Jobs to be prepared:

Job I To make a job by drilling and tapping (manually) process on soft metals- Aluminum or Copper or Bronze.

Job II To Make 'U' type cut-out profile from a square piece of MS flat using hand hacksaw, filing, marking, drilling and measuring operations up to an accuracy of ± 0.1 mm.

Job III Making external threads by die on a job (GI Pipe, PVC pipe, Steel bars etc.) and assembly of different types of elbows, tee, union, socket.

3. SHEET METAL SHOP - II

3.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction and functions of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine, Wood Turning Machine, Wiring Machine, Setting Down Machine, Forming Machine, Fly press etc. Introduction to various metal forming processes e.g. Spinning, Punching, Blanking, cup drawing, Introduction to metal spinning process. Introduction of various types of nuts, bolts, screws etc.

3.2 Demonstration of various machines and types of nuts, bolts, screws etc.

3.3 Jobs to be prepared:

Job I To prepare a utility job like soap case/tray/canister box.

Job II To prepare a job involving soldering or brazing process.

Job III To prepare a cup with the help of simple die and punch on fly press.

Job IV To fabricate a funnel/conduit pipe from GI sheet.

4. ELECTRIC SHOP - II

4.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE), Introduction and use of single phase and three phase supply, its wiring system and importance. Introduction and function of an electric motor for any three-phase electric machine. Estimating and costing of power consumption. Identification and familiarization with the following tools: Tweezers, Screw Drivers (Different sizes), Insulated pliers, Cutters, Sniper, Philips Screw driver (star screw driver), L-Keys.

4.2 Demonstration of dismantling, servicing and reassembling of table/ceiling fan, air-cooler, auto electric iron, heater etc. Testing and reversing direction of rotation of single phase and three phase motors and their wiring methods.

4.3 Job Practice :

Job I Laying 3 phase wiring for an electric motor or any three phase machine.

Job II Connection of single-phase energy meter with supply and load including reading and working out power consumption and cost of energy.

Job III Finding faults in electric circuits, machines, with series testing lamp and multimeter.

Job IV Assembly, dismantling and servicing of any electrical appliances.

Job V Practice on testing single phase and three phase motors by using voltmeter, ammeter and tachometer.

Job VI Connection and wiring practice for reversing direction of rotation of single phase and three phase motors.

5. CARPENTRY SHOP – II

5.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction, parts and functions of Jig saw and radial saw wood working machine, Band saw, Circular saw and Electric Planer. Introduction and basic functions of Wood working lathe and its tools. Saw re-sharpening machine, wood working lathe, Saw Brazing unit.

5.2 Demonstration of Rip Saw, dovetail saw and Tenon saw. Method of sharpening various saws. Demonstration on Band Saw and Circular Saw, Chain and Chisel, Universal wood working machine, Saw re-sharpening machine, Saw Brazing unit.

5.3 Jobs to be prepared:

Job I Preparation of single dovetail joint.

Job II Preparation of mitre joint.

Job III Preparation of a lengthening joint

Job IV Practice of form turning on wood working lathe.

6. SMITHY SHOP – II

6.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE), Introduction to various heat treatment processes e.g annealing, hardening, case hardening, tempering, normalizing etc. Description of various types of power hammers and their usage (Demonstration only).

6.2 Demonstration of power hammer and various types of furnaces.

6.3 Jobs to be prepared

Job I To forge a hook (long 'S' type).

Job II To forge a chisel and acquaint the students with simple idea of hardening and tempering.

Job III To forge square shape on both ends of a circular rod.

Job IV To prepare a job of upset forging process.

6. **ADDITIVE MANUFACTURING SHOP – II**

6.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to Additive Manufacturing, Distinction between Additive Manufacturing and Subtractive Manufacturing, Steps involved in the process of Additive Manufacturing, Classification/types of Additive Manufacturing processes (VAT Photo polymerisation, Material

jetting, binder jetting, Material Extrusion-Fuse deposition modelling, The Powder Bed Fusion, Sheet lamination, Directed Energy Deposition (DED) etc.), Advantages of Additive Manufacturing and types of materials used for Additive Manufacturing (PLA-Polylactic acid, ABS-Acrylonitrile Butadiene Styrene, PET-Polyethylene terephthalate, Nylon, TPU-Thermoplastic polyurethane (Flexible) and PC- Polycarbonate etc.)., applications of additive manufacturing.

6.2 Demonstration of Fused Deposition Modelling (FDM) process of additive manufacturing (particularly 3D printing) and the steps involved (concept, drawing, modelling, exporting CAD data to required format for printing, 3D printing), post processing of parts if required (Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement etc.), Basic maintenance, material (spool) loading, nozzle setting, nozzle cleaning, machine bed preparation

6.3 Jobs to be performed

Job I: Preparation of 3D model of a part using suitable CAD package and saving it in .PRT file format.

Job II: Conversion of .PRT file to .STL file and introduction to processing software (Flashprint)

Job III: Identification of .STL file problems and application of repair algorithms to make the model error-free using suitable software package.

Job IV: Preparation of a simple assembly component by 3D printing the individual parts and post processing if required.

Note :

1. Workshop instructors will guide and help the students throughout the practical class in order to explain and complete the job according to syllabus and for providing necessary facilities to the students during performance of practical by observing the safety precautions
2. The Workshop Superintendent or Foreman Instructor or Foreman will demonstrate and deliver the theoretical instructions with regard to introduction, functions, classification and specification of tools, instruments, equipment, apparatus etc. of all the topics covered in the syllabus.
3. The Workshop Superintendent or Foreman Instructor will also conduct the mid-term test and final practical exam of this subject.

RECOMMENDED BOOKS

1. Singh, Swaran, “Workshop Practice”, S. K. Kataria and Sons, New Delhi.
2. Bawa, H.S., “Workshop Practice”, Tata McGraw Hill Publishers, New Delhi.
3. Hajra, SK, “Workshop Technology I, II, III”, Choudhary and AK Choudhary Media Promoters and Publishers Pvt. Ltd. Mumbai.
4. Manchanda, “Workshop Technology Vol. I, II, III”, India Publishing House, Jalandhar.
5. Raghuwanshi, B.S., “ Workshop Technology”, Dhanpat Rai and Co., New Delhi

TRAFFIC AWARENESS & ROAD SAFETY CAMP (II)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety By obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of Distt. Traffic police. There will be no exam for this camp.

1. Time management
2. Traffic light signals
3. Speed limits of vehicles
4. Schedule of offences
5. Dividing lines
6. Proper road Maintenance and Warnings
7. Test yourself

3.1 AUTOMOTIVE MATERIALS

L	P
3	2

RATIONALE

Materials play an important role in the manufacturing of automobiles and the equipment/tools used in repair of automobiles. Proper selection of materials adds to the life of machinery. A diploma holder must be conversant with the properties, uses, and availability of materials used in manufacturing of different types of vehicles to enable him to perform his functions confidently. The subject of Automotive Materials has been designed to cover the above aspects.

LEARNING OUTCOMES:

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

- Distinguish between metals and non metals, ferrous and non ferrous materials based on different laboratory tests.
- Analyse the composition and microstructure of specimen and change in microstructure due to various heat treatment processes.
- Select suitable material to be used for various engineering applications.
- Interpret iron-carbon diagram.

DETAILED CONTENTS

1. Properties of Materials (08 hrs)

   - Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys
   - Names of common metals, their alloys and non-metals used in Automobile Industry
   - Properties of metals and alloys
   - Physical properties - Appearance, luster, colour, density and melting point
   - Mechanical Properties: Strength, stiffness, elasticity, plasticity, toughness, ductility, malleability, brittleness, hardness, fatigue strength and creep resistance.
   - Thermal and electrical conductivity and corrosion resistance.

2. Ferrous Metals and Alloys (15 hrs)

   - Classification, composition and uses of cast iron and plain carbon steels. IS, BS, EN and SAE Grades
   - Effect of alloying elements such as Carbon, Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorus.

- Composition, properties, grades and uses of alloy steels such as High speed steel, Stainless steel, Heat resistant steel and Spring steel

Heat Treatment : Hardenability of steels, Equilibrium diagram, Iron-carbon diagram, objectives and practical aspects of heat treatment. Description and uses of principal heat treatment processes Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications. Case hardening and surface hardening, Hardenability of steels, Examples in heat treating automobile engineering components

3. Non-ferrous Metals and Alloys (9 hrs)

- Copper: Properties and uses
- Composition, properties and uses of copper alloys.
- Brass: Cartridge brass, Nickel silver.
- Bronze: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.
- Properties and uses of Aluminium and their grades
- Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium
- Properties and uses of alloys of lead, tin and magnesium.
- Bearing Metal: Requisite qualities. Composition, properties and uses of white metal bearing. Copper based bearing metals. Aluminium based bearing metals. Use of nylon/PTFE for bushes/bearings, bi-metallic and tri-metallic bushes

4. Identification and Examination of Metals and Alloys (2 hrs)

Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure.

5. Other Important Materials (08 hrs)

- Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics with specific mention of their uses and grades
- Heat insulating materials: Properties and uses of asbestos, glass wool, thermocole, cork, mica.
- Sound insulating materials: Cork, fibre boards.
- Fabrication materials: Wood, plywood, Rubber - natural and synthetic, Glasses – plate glass, toughened glass, safety glass.
- Insulating materials: Asbestos, mica

- Electrical insulating materials, properties and uses of china clay, leather baklite, ebonite, glasswool, rubber felt

- Refractory materials: General characteristics and uses of dolomite, ceramics.
- Protective coating materials: Auto paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, teflon coating
- Adhesive requirements types and advantages, thread locking special solution, antirust solution

6. Selection and Specifications of Materials (03 hrs)

- Practical considerations for selection of material for different Automobile Components.

- ISO/Bureau of Indian standard specifications for metals, non-metals, auto components and other materials.

LIST OF PRACTICALS

1. Classification of about 25 specimen of materials/parts in material lab

2. Identification of various type of materials with respect to their properties

3. To prepare microscopic structure for examination and to examine the micro structure of specimens of following materials (i) Brass (ii) Copper (iii) Grey CI (iv) Malleable CI (v) Low carbon Steel (vi) High carbon steel (vii) HSS

4. To anneal a given specimen

5. To normalize a given specimen

6. To temper a given specimen

INSTRUCTIONAL STRATEGY

Teacher should show various types of automotive components and parts to students while imparting instructions. Visits to industry should be planned to demonstrate the use of various types of materials in the automobile industry. Students should be asked to collect samples of various materials available in the market

RECOMMENDED BOOKS

1. Narang, GBS, “Material Science”, Khanna Publishers, New Delhi.
2. Choudary, RB, “Material Science and Metallurgy”, Khanna Publishers, New Delhi.
3. Narula, G., “Material Science”, Tata McGraw Hill, Delhi.
4. Rajput, RK, “Material Science”, SK Kataria and Sons, Ludhiana.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted
1	08	09
2	15	16
3	09	10
4	02	03
5	08	09
6	03	03
Total	**45**	**50**

3.2 GARAGE EQUIPMENT

L	P
3	-

RATIONALE

Management of garage forms an important function of automobile technicians. To perform such functions, knowledge of service station equipment, tuning equipment, engine repair tools and reconditioning and fabrication of equipment is very essential. Hence the subject.

LEARNING OUTCOMES :

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

- Use general tools for required application.
- Use appropriate tuning and testing equipment for a given situation.
- Use engine repair tools.
- Use reconditioning/testing equipment for chassis and body.

DETAILED CONTENTS

1. General Tools (6 hrs)
   Specifications and applications of
   - Screw drivers
   - Spanners and wrenches
   - Pliers
   - Hammers
   - Chisels
   - Files
   - Hacksaw
   - Tools for tubes flaring
   - Taps and dies
   - Reamers
   - Soldering tools
   - Measuring tools- vernier calipers, inside and outside micrometers
   - Feeler gauge
   - Tommy bar
   - Nut runner
   - Cleaning tools
   - Nipple forming tools

2. General Equipment (8 hrs)
   Specifications and applications of
   5
   - Bench grinder
   - Air compressor and pneumatic gun
   - Hydraulic and electric hoists
   - High pressure washing equipment (Car washer, Car vacuum cleaner, Buffing tool)

- Oil sprayers
- Grease Guns-manual and bucket type, pneumatic
- Tyre inflation gauge (Manual and Digital type automatic)
- Tyre Changer (Manual and Automatic)
- Creepers
- Fire extinguisher
- First aid box

6

3. Tuning and Testing Equipment (5 hrs)
   Specifications and applications of

- Vacuum Gauge
- Compression Gauge (Pressure Gauge)
- Distributor Tester, cam (dwell) angle tester, r.p.m. tester.
- Spark plug cleaner and tester
- Ignition timing light
- Fuel consumption tester

4. Engine Repair Tools/Measuring and Testing Equipment (8 hrs)
   Specifications and applications of

- Torque wrench, pneumatic wrench
- Piston ring compressor
- Valve lifter and valve spring tester
- Piston ring files, groove cleaner
- Scrappers
- Piston ring remover
- Cylinder Dial gauge
- Engine Analyser/Scanner
- Part degreasing tank

5. Reconditioning/Testing Equipment for Chassis and Body (8 hrs)

   Use of

- Brake Efficiency Tester (Chassis Dynamometer) or brake testing equipment
- Clutch Fixtures and Brake Line Rivetters, pop riveting gun
- Crane and Chain Pulley Block
- Jacks – mechanical, hydraulic, trolley type
- Paint chamber
- Paint Spray Gun
- Paint Drying Equipment
- Tools for tyres, automatic tyre remover
- Trolleys
- Axle/chassis stands
- Steering work stands
- Spring tester
- Frame strengthening equipment
- Chassis alignment equipment

6. Engine Reconditioning and Testing Equipment (10 hrs)
   Specifications and use of

- Cylinder Boring Machine and Honing Machine
- Crankshaft Machine and Camshaft Grinding Machine
- Connecting Rod Aligner
- Line Boring Machine and Arbor Press
- Nozzle Grinding and Lapping Machine
- Valve Refacer, Valve Seat Cutting and Grinding
- Radiator Tester
- Cylinder head leakage testing fixture
- Nozzle cleaning equipment

INSTRUCTIONAL STRATEGY

Teacher should lay emphasis on proper handling and use of garage equipment Demonstration should be made in the workshop for clarity of ideas. Visits to garage should also be planned.

RECOMMENDED BOOKS

1. Srinivasan, "Automotive Mechanics", TMH, Delhi.
2. Singh, Dr. Kirpal, "Automobile Engineering Vol. I and II", Standard Publishers, Delhi.
3. Crouse, WH, and Donald Anglin, "Automotive Mechanics", Tata McGraw Hill Publishing Co. Ltd., Delhi.
4. Aulakh, G.S., "Garage Equipment", Eagle Prakashan, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (Out of 50)
1	6	06
2	8	10
3	5	04
4	8	09
5	8	09
6	10	12
Total	**45**	**50**

3.3 AUTOMOBILE ENGINE - I

L P
3 2

RATIONALE

Engine forms the base of Automobile Engineering. As the scope of automobile engines is very wide, it has been divided into two subjects, Automobile Engine –I and Automobile 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.

LEARNING OUTCOMES :

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

- Explain the principles of operation of an internal combustion engine.
- Classify various types of engines.
- Explain the principle of operation of fuel supply system.
- Explain the principle of operation of ignition system.
- Explain the principle of operation of engine cooling and lubrication system.
- Carryout servicing of lubrication and cooling system.

DETAILED CONTENTS

1. Introduction

(07 hrs)

- Engines, internal and external combustion Engines, Engine terminology including Bore, Stroke, dead centres, Compression Ratio, Swept volume, clearance volume, compression ratio, Engine capacity, Engine torque, Indicated power, Brake power, Friction power

- 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.

2. Engine Components (08 hrs.)

Construction details, specification, function and working of components, cylinder block, head, cylinder liner, piston, piston rings, wrist pin, connecting rod, crankshaft bearing, camshaft, valves and valves mechanisms. flywheel and dampers.

3. Fuel System in spark Ignition Engine (10 hrs)

Fuel System: types of fuel feed system, gravity and pump feed. Fuel injection system, Fuel tank, fuel lines, fuel filters, carburetion, working of simple carburetor and its limitation.

Circuits of complete carburetor: Float circuit, starting and choke circuit, idling, low speed, high speed part load and full load circuits. Construction and working of simple carburetor dry and wet air cleaners. Intake and exhaust manifold, mufflers.

Petrol Injection: - Introduction, Comparison with Carburetor method, Description and working of multipoint fuel injection (M.P.F.I.), Advantages and disadvantages of M.P.F.I., Sensors.

4. Ignition system (05 hrs)

Concept of ignition system, types of ignition systems, Battery/coil and magneto ignition system, Function and working of ignition coil, distributors, condenser, advance mechanisms, C.B. Point and gap, spark plugs and gaps pertaining to Indian vehicles., Distributor less Ignition System.

5. Cooling System (05 hrs)

Cooling system, necessity, types (air, water), pump circulation cooling., Advantages & Disadvantages of Air cooling & water cooling, Components of Water cooling system- Radiators, thermostat, water pump, Fan, Pressure cap, Water jackets, anti-freeze solution, trouble shooting and remedies.

6. Lubrication System (05 hrs)

Necessity and types of Lubrication system (Splash System, Pressure system), wet and dry sump, Components used, oil pump, oil lines, oil filters, oil coolers, crankcase ventilation, characteristics, classification and service ratings of lubricating oil, additives for lubricants.

LIST OF PRACTICALS

1. Sketching and working of basic components of an automobile engine such as cylinder block, cylinder head, piston, connecting rod and crankshaft.
2. Testing of mechanical fuel pump.
3. Servicing of water-cooling system, radiator, fan, pump, and thermostat.
4. Servicing of two-wheeler carburetor.
5. Servicing of lubrication system.
6. Testing and cleaning of Fuel injector (Petrol Engine).

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.

RECOMMENDED BOOKS

1. Singh, Dr. Kirpal, "Automobile Engineering – Vol. II", Standard Publishers Distributors.
2. Gupta, R.B., "Automobile Engineering", Satya Prakashan, New Delhi.
3. Srinivasan, "Automotive Engines", TMH, Delhi.
4. Chikara, "Automobile Engineering", Dhanpat Rai and Sons, New Delhi.
5. Gupta, KM, "Automobile Engineering", Umesh Publishers, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted
1	7	8
2	8	9
3	5	6
4	10	12
5	5	5
6	5	5
7	5	5
Total	**45**	**50**

3.4 AUTOMOBILE ENGINEERING DRAWING

L	P
-	6

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..

LEARNING OUTCOMES:

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

- Prepare drawings of automotive components.
- Interpret various drawing used in automobile engineering.
- Compare hole basis system with shaft basis system and choose fits and tolerances for various mating parts.

DETAILED CONTENTS

1. Limits, Fits and Tolerances (01 sheet)
   Limit, tolerance, Geometrical Tolerance, deviation, allowance, fits: clearance, interference, transition fit, Hole and shaft basis system.

2. Assembly Drawings of the following automotive components:

   Joints and Bearings (04 sheets)

   - Universal joint,
   - Slip joint
   - Bush bearing
   - Plummer block or pedestal bearing
   - Ball bearing
   - Roller bearing- Straight and Needle type

3. Drawings of the following automotive components and equipment: (06 sheets)

   - Four Stroke Petrol Engine Piston
   - Diesel Engine Piston
   - Connecting rod
   - Fuel injector

- Crank shaft – 4 cylinder Engine
- Cam shaft
- Spark Plug
- Screw Jack

4. Drawing of following components:

4.1 Chassis components (05 sheets)
- Shock absorber
- Wheel cylinder
- Master Cylinder
- Brake drum (assembly)
- Singe plate clutch

4.2 Gears
- Nomenclature of gears (2 sheets)
- Profile of spur gear by 'Approximate method'
- Profile of spur gear by "Unwin's Method'

4.3 Cam Profile (3 sheets)
- Different types of cams and followers
- Drawing of cam profile for following motion of follower
  (a) Uniform velocity motion
  (b) Simple harmonic motion (SHM)
  (c) Uniformly accelerated and retarded motion.

5. Free hand sketching (2 sheet)

- Battery ignition system
- Magneto ignition system
- Lighting system
- Leaf spring suspension
- Overhead and side valve mechanism

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.

Note:- (1) First angle projection should be followed, 20% of drawings may be prepared in third angle projection.
(2) The drawing should include discussion with tolerances, whenever necessary and material list as per BIS / ISO specifications.
(3) 50% of the practice needs to be done using Auto CAD software. Auto CAD drawings will be evaluated internally by sessional marks and not by final theory paper.

RECOMMENDED BOOKS

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

3.5 WORKSHOP TECHNOLOGY-1

L	P
3	6

RATIONALE

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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Fabricate welding joints using gas welding arc welding, TIG, MIG/MAG welding of mild steel and stainless steel materials.
- Select suitable (most appropriate) process electrodes, various parameters of process for given job.
- Explain principle of operations of modern welding processes.
- Inspect various welding joints, castings, forgings.
- Prepare pattern for given job.
- Select material and type of patterns, cores.
- Prepare sand moulds manually and on machine.
- Select type of moulding sand, adhesives, compact, strength and parameters of sand for given job.
- Cast a mould.
- Identify a suitable furnace, alloying elements
- Carry out deburring of castings.
- Test the properties of moulding sand (permeability, Strength, refractoriness, adhesiveness, cohesiveness).
- Operate forging machine, press, and spinning machine.
- Explain the principle of rolling, extrusion and drawing process.

DETAILED CONTENTS

1. Welding (18 hrs)

1.1 Welding Process

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

1.2 Gas Welding

Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - Gas welding torch, Oxy acetylene cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes. Oxy-Acetylene gas welding, Oxy-Acetylene gas cutting.

1.3 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.

1.4 Other Welding Processes

Resistance welding: Principle, advantages, limitations, working and applications of spot welding, seam welding, flash butt welding, projection welding, Shielded metal arc welding, submerged arc welding, welding defects and their remedies, inspection of welded joints.

1.5 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, Plasma arc welding, Friction welding, Robotic welding,

2. Pattern Making (03 hrs)

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

3. Moulding and Casting (16 hrs)

3.1 Moulding Sand

Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility, Various types of moulding sand, Testing of moulding sand. Different hazards associated with foundry practice and safety precautions to be followed.

3.2 Mould Making Process and Equipment

Types of moulds, Step involved in making a mould, Moulding boxes, hand tools used for mould making, Moulding processes: Bench molding, floor moulding, pit moulding and machine moulding,

Moulding machines squeeze machine, jolt machine, jolt squeeze machine and sand slinger.

3.3 Casting Processes and Equipment

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, Investment and lost wax process, Centrifugal casting.

3.4 Gating System

Elements of gating system, Pouring basin, sprue, runner, gates, Types of risers, location of risers, Directional solidification

3.5 Melting Furnaces

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

3.6 Casting Defects

Different types of casting defects, Testing of defects: Visual inspection, radiography, magnetic particle inspection and ultrasonic inspection.

4. Metal Forming Processes (5 hrs)

4.1 Press Working - Types of presses, type of dies, selection of press die, die material. Press Operations-Shearing, piercing, trimming, punching, notching, shaving, gearing, embossing, stamping

4.2 Forging - Open die forging, closed die forging, Press forging, upset forging, roll forging, Cold and hot forging, Forging operations - swaging, upsetting, Fullering, bending, edging, drifting etc.

4.3 Rolling - Elementary theory of rolling, Types of rolling mills, Thread rolling, roll passes, Rolling defects and remedies

4.4 Extrusion and Drawing - Type of extrusion- Hot and Cold, Direct and indirect. Type of drawing: Deep drawing, shallow drawing, bar drawing, Pipe drawing, tube drawing, wire drawing.

5. Plastic Processing (3 hrs)

5.1 Industrial use of plastics and situations where used.

5.2 Injection moulding-principle, working of injection moulding machine.

5.3 Compression moulding-principle, and working of compression moudling machine.

5.4 Principle, construction and working of Blow Moulding Machine.

LIST OF PRACTICALS

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

Welding Shop

Job 1. Preparation of gas welding joint in vertical/horizontal position by M.S. flats
Job 2. Gas welding of cast iron and brass part or component.
Job 3. Preparation of a joint by spot welding.
Job 4. Preparation of a joint by Seam welding
Job 5. Preparation of a T joint by MIG welding while keeping in check the perpendicularity between the plates.
Job 6. Preparation of a T joint by TIG welding while keeping in check the perpendicularity between the plates.
Job 7. Preparation of MS pipe joint by arc welding. Or
Preparation of a joint by Flash Butt Welding.

Pattern making

Job 1. Preparation of solid/single piece pattern.
Job 2. Preparation of two piece/split pattern.
Job 3. Preparation of a pattern on woodworking lathe.
Job 4. Preparation of a self-cored pattern
Job 5. Preparation of a core box.

Foundry Shop

Job 1. Preparation of mould with solid pattern on floor or using cope.
Job 2 Preparation of a core and core prints.
Job 3. Preparation of floor mould of split pattern in cope and drag of moulding box.
Job 4. Preparation of a mould of step pulley with provision of core.
Job 5. Sand testing (Testing of moisture content, clay content, shatter index, green compressive strength etc.).

Forging Shop/Fitting Shop/Sheet Metal Shop

Job 1. Preparation of single ended spanner by hand/machine forging.
Job 2. Preparation of simple die
Job 3. Demonstration of grinding process on lathe machine and grinding a job on a lathe machine
Job 4. Preparation of drilling Jig.
Job 5. Preparation of utility item out of G.I. sheet.
Job 6. Demonstration of spinning process on lathe and spinning a bowl on a spinning lathe machine.
Job 7 Preparation of a job by hand moulding machine.

Note : A visit to cast iron foundry should be arranged to have first hand knowledge of cast iron melting pouring and casting.

INSTRUCTIONAL STRATEGY

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.
4. Foreman 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.

LIST OF RECOMMEMDED BOOKS

1. Raghuvanshi, BS, "Workshop Technology Vol I and II", Dhanpat Rai and Sons, Delhi.
2. Choudhry, SK, and Hajra, "Elements of Workshop Technology", Asia Publishing House.
3. Aggarwal, RL, and T Manghnani, "Welding Engineering", Khanna Publishers, Delhi.
4. Sharma, PC, "A Text Book of Production Engineering", S Chand and Company Ltd., Delhi.
5. Rao, P. N., "Manufacturing Technology Vol I, II, III", McGraw Hill Publications, Noida, UP.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	18	20
2	03	4
3	16	16
4	05	6
5	03	4
Total	**45**	**50**

3.6 OPEN ELECTIVE

L	P
2	-

RATIONALE

Open Elective refers to a course that students can opt for in addition to their primary area of study. The open electives is from an unrelated discipline with the intention to provide exposure in that discipline. It provides the students the opportunity to select and learn a subject related to his/her interest, thus allowing them to explore their passion..

LIST OF SUGGESTED OPEN ELECTIVES

The student can opt one course out of the following :

1 Foreign Language
2 National Cadet Corps (NCC)
3 Yoga
4 First Aid
5 Creative Writing
6 Sketching, Drawing and Colour Studies
7 Gardening
8 Photography
9 Legal Studies
10 Event Management
11 Diet and Nutrition

Open elective can be offered online or offline.

3.6.1 FOREIGN LANGUAGE
(French, Japanese, German, Spanish)

L	P
2	-

RATIONALE

This course is an introduction to the specific language. Learning to understand and articulate oneself in day to day real life situations, and to begin to make sense of the language as a cultural space are the overall objectives of the course. The student should be able to grasp the basic sentence structure and build a good foundational vocabulary through this course.

LEARNING OUTCOMES

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

- Enhance the level of vocabulary in specific language.
- Manage situational communication in specific language.

DETAILED CONTENTS

1. Introduction (06 hrs)

   Self introduction, Numbers, Days, Months, Date, Time, and Counting

2. Vocabulary (06 hrs)

   My home, My family, My friend, Daily routine, Hobbies, Food, Greeting and Thanking

3. Grammar (12 hrs)

   Verb and Verb forms, Articles, Possessive pronouns, Auxiliary verbs, Questions, Present and Past tense

4. Theme (06 hrs)

   Means of transport, Basic directions, Food, Drink, Family, Groceries and Meals

RECOMMENDED BOOKS

1. Annie Berthet, Hugot et al, “Alter Ego - Méthode de Français”, Hachette.
2. 3 A Corporation, “Minna no Nihongo”, Goyal Publishers, New Delhi.
3. Stefanie Dengler, “NETZWERK Deutsch als Fremdsprache A1”, Goyal Publishers, New Delhi.
4. Jaime Corpas et.al, “Aula International 1”, Difusión, Madrid.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	06	10
3	12	20
4	06	10
Total	**30**	**50**

3.6.2 NATIONAL CADET CORPS (NCC)

L	P
2	-

RATIONALE

This course is structured to instil in the students qualities like nationalism, patriotism, discipline, team spirit, esprit-de-corps, leadership, self-confidence, national integration and improve their personality. The objective of the course is to expose the students to a regimental way of life, which is essential to inculcate in them the values of discipline, duty, punctuality, orderliness, smartness, and respect for authority, correct work ethos and self-confidence. In addition, it will inculcate defence services work ethos, which is characterized by hard work, sincerity of purpose, honesty, ideals of selfless service, dignity of labour, secular outlook, comradeship, spirit of adventure and sportsmanship.

LEARNING OUTCOMES

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

- Explain aims and objectives of NCC.
- Understand the importance of national integration.
- Assist Civil Administration in performance of selective duties during disasters.
- Perform drill without arms.
- Contribute towards nation building.
- Provide voluntary social service.

DETAILED CONTENTS

1. Introduction (08 hrs)

   Aims and objectives of NCC, Organisation structure and training, NCC Song, National Integration and awareness, Religions, Culture, Traditions and Customs of India, National Integration: Importance and Necessity. Freedom Struggle and Nationalist Movement in India, Problems/ Challenges of national integration, Unity in diversity, Famous leaders of India, Images/ Slogans for national integration, Contribution of youth to nation building

2. Civil Affairs (04 hrs)

Civil Defence Organization and its duties/ NDMA, Types of emergencies/ Natural Hazards, Role of NCC during Natural Hazards/ Calamities

3. Drill Without Arms (08 hrs)

General and Words of Command, Attention, Stand at Ease and Stand Easy, turning and inclining at the halt, Sizing, forming up in three ranks and numbering, open and close order march and Dressing, Saluting at the halt, Getting on parade, dismissing and falling out, Marching, length of pace and time of marching in quick time and halt, slow march and halt, Turning on the march and wheeling, Saluting on the March Individual word of command

4. Personality Development and Leadership (04 hrs)

Personality development, self-awareness, Leadership, life/soft skills, time management
and character building.

5. Social Service (06 hrs)

Basics of Social service, and its needs, Social/ Rural Development Projects: MNREGA, SGSY, NSAP; Literacy enhancement and poverty alleviation, Social evils, Contribution of youth towards social welfare.

RECOMMENDED BOOKS

1 "Cadet Hand Book (Common Subjects)", published by DG, NCC.
2 "Grooming Tomorrow's Leaders", published by DG, NCC.
3 "Youth in Action", published by DG, NCC.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	14
2	04	06
3	08	14
4	04	06
5	06	10
Total	**30**	**50**

3.6.3 YOGA

L	P
2	-

RATIONALE

Yoga is a practice that connects the body, breath, and mind. It uses physical postures, breathing exercises, and meditation to improve overall health. It not only improves physical health but also mental and spiritual well-being, which are the foundations of life. The course is aimed at developing skills in yoga for strength, flexibility and relaxation.

LEARNING OUTCOMES

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

- Explain the importance of yoga and its effect on health
- Perform yoga in various forms and combinations
- Understand the philosophy of heartfulness meditation.
- Promote positive health and holistic wellness through yoga and meditation.

DETAILED CONTENTS

1. Yoga (4 hrs)

   Concept, need and importance, Yogic principles, Rules and precautions to be followed by yoga practitioners, Introduction to Ashtanga yoga and Yoga sutra

2. Asanas and Mudras (14 hrs)

   Basic asanas, Asanas in different postures - Sukshma Vayayam, Pawan Muktasan, Surya Namaskar, Hasta Utthanasana, Padahastasana, Tadasana, Vrikshasana,Tirayak Tadasana, Natarajasana, Vajrasana, Padmasana, Bhujangasana.
   Mudras - Concept, Important mudras - Prana Mudra, Varuna Mudra, Prithvi Mudra, Aakash Mudra, Gyana Mudra.

3. Pranayama (6 hrs)

Kapalbhati Pranayama, Nadi Shodhan Pranayama (Anulom Vilom), Bhastrika Pranayama, Ujjayi Pranayama.

4. Meditation (3 hrs)

Heartfulness meditation, Practice on meditation

5. Health Benefits of Yoga and Meditation (3 hrs)

Benefits and effect of Asanas, Mudras and Pranayama on various systems and organs of human body. Relaxation and wellness through meditation

RECOMMENDED BOOKS

1. Saraswati, Swami Satyananda, "Asana, Pranayama, Mudra and Bandha", Yoga Publication Trust, Bihar.
2. BKS Iyengar, "Light on Yoga", George Allen and Unwin.
3. Mudras by Heartfulness; Heartfulness Education Trust.
4. Kamlesh D Patel, "The Way of the Heart", Spiritual Hierarchy Publication Trust
5. Goel, Aruna, "Yoga Education: Philosophy and Practice", Deep & Deep Publications, New Delhi.
6. Nagendra, H R, and R Nagarathna, "Yoga for Promotion of Positive Health". Swami Vivekananda Yoga Prakashan.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	14	24
3	06	10
4	03	05
5	03	05
Total	**30**	**50**

3.6.4 FIRST AID

L	P
2	-

RATIONALE

First aid is a valuable and life-saving course. The objective of this course is to impart knowledge and skills to the students necessary in an emergency to help sustain life, reduce pain, and minimize the consequences of injury or sudden illness until professional medical help
arrives.

LEARNING OUTCOMES

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

- Administer basic life support skills including cardiopulmonary resuscitation
- Provide first aid of simple and multiple system trauma.

DETAILED CONTENTS

1. Basics of First Aid (4 hrs)

   First aid, importance of first aid, first aider, laws of first aid, contents of an ideal first aid kit, dealing with an emergency.

2. Emergency Response (10 hrs)

   CPR, steps for performing CPR,CPR for newborns and infants, recovery position, first aid in drowning, fractures of bones, causes and types of fractures, dislocation.

3. First Aid in Burns (4 hrs)

   Types of burns, danger of burns, first aid in dry burns and scalds, electrical burns, chemical burns, sunburn, heatstroke.

4. First Aid in Wounds and Injuries (6 hrs)

Types of wounds- small cuts and abrasions, Head injury- nose bleed, bleeding gums, bleeding from varicose veins, Shocks- causes of shock and its first aid.

5. First Aid in Poisoning (3 hrs)

Poisoning by swallowing, gases, injections, skin absorption, Animal bites, snake bites and insect stings.

6. First Aid in Foreign Objects Entering the Sense Organs: (3 hrs)

Foreign body in the eye, ear, nose, skin, swallowing of foreign objects.

Note : Persons from Civil Defence/ National Disaster Response Force (NDRF) etc. can be invited for conduct of first aid classes and demonstration of first aid practices.

RECOMMENDED BOOKS

1. Gauri Goyal, Dr. Kumkum Rajput, Dr. Manjul Mungali,, "First Aid and Health", SBPD Publishing House
2. Williamson, Swapna Naskar and Goswami Mala, "First Aid and Emergency Care", Kumar Publishing House, New Delhi.
3. Mahopatra, R., "First Aid for You and Me", Academic Publishers, New Delhi.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	10	18
3	04	06
4	06	10
5	03	05
6	03	05
Total	**30**	**50**

3.6.5 CREATIVE WRITING

L	P
2	-

RATIONALE

Creative writing is a written art form that uses the imagination to tell stories and compose essays, poetry, screenplays, novels, lyrics, and more. The objective of this course is to acquaint the students with ideas related to creative writing including art, craft and basic skills required for a creative writer.

LEARNING OUTCOMES

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

- Distinguish between literary genres.
- Practice various forms of creative writing.
- Write for various media.

DETAILED CONTENTS

1. Fundamentals of Creative Writing (06 hrs)

   Meaning and significance of creative writing, Genres of creative writing: poetry, fiction, Non-fiction, Drama and other forms, Research for creative writing

2. Elements of Creative Writing (10 hrs)

   Plot, Setting, Character, Dialogue, Point of view, Literary devices and figurative language, Elements of style, Grammar and the structure of language, Proof reading and editing

3. Traditional Forms of Creative Writing (10 hrs)

   Fiction: short story, novella and novel, Poetry, Drama, Essay, Fable, Biography, Memoire and autobiography, Travelogues, Diaries, Self-narrative writing

4. Writing for Media (04 hrs)

Print media, Broadcast media, Internet - Web content writing and blog writing, Advertising

RECOMMENDED BOOKS

1. Anjana Neira Dev. Anuradha Marwah, Swati Pal, "Creative Writing: A Beginner's Manual", Pearson Longman, Delhi
2. Robert Scholes, Nancy R. Comley, Carl H. Klaus, Michael Silverman, "Elements of Literature: Essay, Fiction, Poetry, Drama, Film", Delhi
3. Bell, Julia and Magrs, Paul, "The Creative Writing Course-Book", Macmillan, London
4. Gardner, John, "The Art of Fiction", Vintage, New York

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	6	10
2	10	16
3	10	16
4	4	08
Total	**30**	**50**

3.6.6 SKETCHING, DRAWING AND COLOUR STUDIES

L	P
2	-

RATIONALE

This course is aimed to develop aesthetic sense of students. It also encompasses training in sketching, drawing and colouring to develop their mental faculties of observation, imagination and creation.

LEARNING OUTCOMES

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

- Sketch common objects and various geometrical and non-geometrical forms found in life and nature.
- Use different medium and materials.
- Use colour judiciously in creation of visual work.
- Prepare collage using various paper and materials.

DETAILED CONTENTS

1. Sketching of Objects and Nature (8 hrs)

   Sketching of objects at home like cup, plate, glass, book, pencil box etc.
   Sketching of tree, mountain, hills, vegetables flower etc. for Nature study using Pencil, colour Pencil

2. Drawing of Human and Animal Figures (10 hrs)

   Drawing of Human and animal form with the help of Basic Geometrical shapes

3. Collage Making (4 hrs)

   Creating Collage with the help of coloured cut out papers, picture from a magazine or any easily available materials

4. Colours (8 hrs)

Water colour, Poster colour, Colour theory – Colour system, Colour wheel, Colour dimensions, Drawing with oil pastel colour and dry pastel.

RECOMMENDED BOOKS

1. Betty Edwards, "Color: A Course in Mastering the Art of Mixing Colors", Penguin Group Inc., New York
2. Feisner, E., "Colour Studies", Fairchild Publications, USA

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	14
2	10	16
3	04	06
4	08	14
Total	**30**	**50**

3.6.7 GARDENING

L	P
2	-

RATIONALE

Gardening activities are fantastic for helping students engage in a way that is more difficult in the classroom. Watching plants grow is a fun and educational experience for them. Their enormous curiosity and excitement over anything new makes them natural for gardening. Growing plant seeds teaches them how nature works and adds to their interest in environmental sustainability.

LEARNING OUTCOMES

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

- Explain various techniques of gardening, cultivation, multiplication, raising of seedlings of garden
- Discuss new and modern techniques of plant propagation.
- Develop interest in nature and plant life.

DETAILED CONTENTS

1. Gardening (6 hrs)

   Definition, objectives and scope. Different types of gardening - landscape and home/ terrace gardening, parks and its components. Plant materials and design.

2. Gardening Operations (14 hrs)

   Soil laying, manuring, watering, management of pests and diseases and harvesting.

3. Sowing/Raising of Seeds and Seedlings (10 hrs)

   Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion Seed production technology. Seed testing and certification. Transplanting of seedlings.

RECOMMENDED BOOKS

1. Bose T.K., Mukherjee, D., “Gardening in India”, Oxford & IBH Publishing Co. New Delhi.
2. Kumar, N., “Introduction to Horticulture”, Rajalakshmi Publications. Nagercoil, Tamil Nadu.
3. Sandhu, M.K., “Plant Propagation”, New Age International Publishers.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	14	24
3	10	16
Total	**30**	**50**

3.6.8 PHOTOGRAPHY

L	P
2	-

RATIONALE

Photography is a unique and creative medium of self-expression that requires aesthetic sense as well as technical expertise. Students who are highly passionate about learning the workings of cameras and different technologies based on them can pursue this course. The objective of this course is to enable the candidates to understand the utility of different camera parts and the art of taking candid shots.

LEARNING OUTCOMES

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

- Explain the principles of photography.
- Handle various cameras for taking photographs.
- Apply aesthetics of photography.

DETAILED CONTENTS

1. Basic Photography (04 hrs)

   Meaning and definition of photography, Basic principle in the film and digital photography, History of photography.

2. Camera Function and Accessories (04 hrs)

   Basic camera, Different parts of camera and their basic functions, Camera Accessories

3. Main Controls of Camera (10 hrs)

   Parts of Camera, Types of lenses, Shutter, Diaphragm, Exposure, Film and digital image sensor, Depth of field, Lighting, Photography with flash, Filters in photography.

4. Digital Camera (05 hrs)

Process of digital imaging, Types of digital cameras, Menu operationsof digital cameras, Introduction to colors.

5. Aesthetics of Photography (07 hrs)

Definition of lighting, Principles of lighting, Reflection, Light characteristics, Color, Direct light and indirect light, Light and subject, Light as subject, Shadow as subject, Light sources, Natural light and artificial light, Principles of visualization, Composition guidelines

RECOMMENDED BOOKS

1. Dilwali, Ashok, "All about Photography", National Book Trust, New Delhi.
2. Sharma, O.P., "Practical Photography", Hind Pocket Books.
3. Freeman, "The Photographer's Guide to Light", John Collins & Brown

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	04	08
3	10	16
4	05	08
5	07	12
Total	**30**	**50**

3.6.9 LEGAL STUDIES

L	P
2	-

RATIONALE

The course introduces the students to Indian legal system, contracts management, and legal documentation. Further, the course familiarizes students with basic knowledge of labour laws that would be useful.

LEARNING OUTCOMES

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

- Understand the Indian Legal System.
- Discuss Indian Contract Act.
- Explore labour laws and laws related to women.

DETAIL CONTENTS

1. Introduction to Indian Legal System (4 hrs)

   Constitution of India, Sources of Law and Judicial system.

2. The Indian Contract Act (6 hrs)

   Contract – meaning and kinds. Essentials of a valid contract, Discharge of a contract, Contract of Agency

3. Legal Documentation (10 hrs)

   Drafting of legal documents including Non-Disclosure Agreements (NDA), Request for Proposal (RFP), collaboration agreements, joint venture agreements, tendering and subcontracting

4. Labour Laws (6 hrs)

   Provident Fund, ESIC, Gratuity and Bonus

5. Legislation Related to Women (4 hrs)

Sexual harassment at Work place (Prevention, Prohibition and Redressal), Protection of Women from Domestic Violence Act, Criminal Law (Amendment) Act, The Indecent Representation of Women (Prohibition) Act.

RECOMMENDED BOOKS

1. Joseph Minattur, "Indian Legal System", Indian Law Institute, New Delhi.
2. Srivastava, S.C., "Industrial Relations and Labour Laws", Vikas Publishing House Pvt. Ltd.
3. Aggarwal, S K, "Business Law", Galgotia Publishers, Delhi.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	07
2	06	10
3	10	16
4	06	10
5	04	07
Total	**30**	**50**

3.6.10 EVENT MANAGEMENT

L	P
2	-

RATIONALE

Event Management is a course which deals with the planning, coordinating, and organising of events for people and communities. It is a part of the mass communication course which is offered by many prestigious colleges in India. Event management course aims to imbibe knowledge on analysing, marketing, planning and strategies in business administration to its students.

LEARNING OUTCOMES

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

- Explain the purpose of special events in an organization.
- Use techniques and strategies required to plan successful special events.
- Promote and conduct special events.
- Assess the quality and success of special events.

DETAILED CONTENTS

1. Principles of Event Management (04 hrs)

   Introduction to event management, size & type of event, event team, code of ethics, principles of event management, role of event manager – planning, organising, leading and controlling an event

2. Event Planning (08 hrs)

   Objective of event, use of planning tools, protocols, dress codes, staging, staffing.

3. Event Marketing (04 hrs)

   Advertising, publicity, event marketing process, even hospitality

4. Event Leadership (06 hrs)

Teambuilding & work distribution, managing team, managing meetings, written & verbal communication.

5. Event Safety and Security (04 hrs)

Role of Security, Safety, Crowd management, Risk management.

6. Event Accounting (04 hrs)

Budget, Cash flow analysis, Profit & loss statement, Balance sheet.

RECOMMENDED BOOKS

1. Singla, Sita Ram, "Event Management", ATH Publishers, New Delhi.
2. Sharma, Divakar, "Event Planning and Management", Deep & Deep Publication.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	06
2	8	12
3	4	08
4	6	10
5	4	08
6	4	06
Total	**30**	**50**

3.6.11 DIET AND NUTRITION

L	P
2	-

RATIONALE

The objective of this course is to help the students to understand the concept of diet and nutrients and provide knowledge about causes and symptoms of Nutrition-related disorders.

LEARNING OUTCOMES

On completion of this course, the students will be able to:

- Comprehend the nutritional value of different food items.
- Explain the need of nutrition during the normal stages of life.
- Calculate normal dietary requirements and balanced diet.

DETAILED CONTENTS

1. Introduction (04 hrs)

   Basic concepts of health, Nutrition, Nutrients, Nutrition requirement, Balanced diet. Relationship between health & nutrition, Assessment of nutritional status.

2. Nutrients (16 hrs)

   Nutrients & their classification. Macro Nutrients –Sources, Functions and Effects on the Body; Micro nutrients - sources, Functions and effects on the Body; Fat soluble nutrients - sources, Functions and effects on the body, Water soluble nutrients - Sources, Functions and effects on the body, Digestion, Absorption of carbohydrates, Lipids, Proteins and energy.

3. Energy and Nutrition-related Disorders (06 hrs)

   Basic concepts, Definition and components of energy requirement, Protein malnutrition, Iodine deficiency disorders, Disease and disorder caused by imbalance of nutrients, Food allergies.

4. Nutritional Needs (04 hrs)

Nutritional need during normal stages of life - Infancy, Childhood, Adolescence, Pregnancy, Lactation and Old age, Disease management with diet.

RECOMMENDED BOOKS

1. Antia, F.P., "Clinical Dietetics and Nutrition", Oxford University Press.
2. Swaminathan, "Essentials of Food and Nutrition", Ganesh and Co., Madras.
3. Subhangini Joshi, "Nutrition and Dietetics", McGraw Hill Publishers.
4. B.S. Narsinga Rao et al, "Nutritive Value of Indian Foods", National Institute of Nutrition, Hyderabad.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	16	28
3	06	10
4	04	06
Total	**30**	**50**

ENERGY CONSERVATION AWARENESS CAMP

A diploma holder must have knowledge of various tips of energy conservation. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This camp covers the basic concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in household appliances and star rating. Lectures will be delivered on following broad topics. There will be no exam for this camp.

1. Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy

2. Introduction to energy management, energy conservation, energy efficiency and its need

3. Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance

4. Standards and Labeling

   - Concept of star rating and its importance
   - Types of product available for star rating

5. Salient Features of Punjab Energy Conservation Building Code (ECBC)

6. General Energy Saving Tips in:

   - Lighting System
   - Room Air Conditioners
   - Refrigerators
   - Water Heater
   - Computers
   - Fans, Heaters, Blowers and Washing Machines
   - Colour Television
   - Water Pumps
   - Kitchens
   - Transport

DRUGS USE AND ABUSE AWARENESS CAMP

This is to be organized at a stretch for two to three days during third semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

1. Drugs Use and Abuse in Society
    b. Concept and overview
    c. Extent of the problem
    d. Drug use as a social problem
    e. Causes of Drug Use: Biological, Socio-cultural, psychological

2. Types of Dugs and identification of Abuse
    a. Familiar drugs: Tabacco, Caffeine, over the counter drugs
    b. Restricted Drugs: Opiates, Hallucinogens, Marijuana
    c. Reformance enhancing drugs
    d. Uppers and Downers: Stimulants and Depressants

3. Impact of Drug Abuse
    a. Individual level biological and psychological
    b. Family social, National

4. Management and Prevention of Drug Abuse
    a. Medical and psychological
    b. Role of family School , Media and Legislation

4.1 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

L	P
3	-

RATIONALE

Generic Skills and Entrepreneurship Development is one of the courses from "Human Science" subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aims at developing conceptual understanding for setting-up one's own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager. Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma pass-outs for enhancing their employability and self confidence.

LEARNING OUTCOMES

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

- Explain the importance of generic skills
- Manage himself/herself physically, intellectually and psychologically
- Work effectively as a team member
- Manage tasks effectively
- Develop an entrepreneurial mindset.
- Identify entrepreneurial support system for new ventures and small businesses.
- Recognize a business opportunity.
- Conduct market survey and prepare project report.

DETAILED CONTENTS

1. Introduction to Generic Skills (04 hrs)

   1.1 Importance of Generic Skill Development
   1.2 Life Long Learning and associated importance of Generic Skill Development

2. Managing Self (07 hrs)

   2.1 Knowing Self for Self Development
   - Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.

   2.2 Managing Self - Physical
   Personal grooming, Health, Hygiene, Time Management
   2.3 Managing Self – Intellectual development

- Information Search: Sources of information
- Communication: Official & business correspondence, Job application covering letter and resume

2.4 Managing Self – Psychological

- Stress, Emotions, Anxiety-concepts and significance
- Techniques to manage stress

3. Managing in Team (06 hrs)

3.1 Team - definition, team dynamics
3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background

4 Task Management (03 hrs)

4.1 Task Initiation, planning, execution, close out
4.2 Exercises/case studies on task planning towards development of skills for task management

5. Problem Solving (05 hrs)

5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
5.2 Different approaches for problem solving.
5.3 Steps followed in problem solving.
5.4 Exercises/case studies on problem solving.

6. Entrepreneurship (20 hrs)

6.1 Introduction

- Concept/Meaning and its need
- Qualities of an entrepreneur
- Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

6.2 Obtaining financial assistance through various government schemes like Prime Minister Employment Generation Program (PMEGP) Pradhan Mantri Mudra Yojana (PMMY) , Make in India, Start up India, Stand up India , National Urban Livelihood Mission (NULM); Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).

6.3 Market Survey and Opportunity Identification (Business Planning)

- How to start a small scale unit/ industry

- Procedures for registration of small-scale unit /industry
- Assessment of demand and supply in potential areas of growth.
- Understanding business opportunity
- Considerations in product selection

6.4 Project Report Preparation

- Preliminary Project Report
- Techno-Economic Feasibility Report
- Exercises on preparation of Detailed Project Report

INSTRUCTIONAL STRATEGY

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may also be provided relevant text material and handouts.

RECOMMENDED BOOKS

1. Balasubramanian, S., "Soft Skills for Interpersonal Communication", Orient Black Swan, New Delhi.
2. "Lifelong learning", Policy Brief (www.oecd.orf).
3. Rathore, BS, and Dr JS Saini, "A Handbook of Entrepreneurship", Aapga Publications, Panchkula (Haryana).
4. Gupta, CB, and P Srinivasan, "Entrepreneurship Development", Sultan Chand and Sons, New Delhi.
5. "Entrepreneurship Development", Tata McGraw Hill Publishing Company Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	04	06
2.	07	08
3.	06	06
4.	03	04
5.	05	06
6.	20	20
Total	**45**	**50**

4.2 AUTOMOBILE ENGINE - II

L	P
3	2

RATIONALE

This subject is in continuation to Automobile Engine –I. It covers diesel engines and other types of engines. It also includes combustion, testing and performance of I.C engine and its emission control. Brief description of engines of modern vehicles has also been included in this subject.

LEARNING OUTCOMES:

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

- Explain the phenomenon of combustion in I.C engine.
- Explain the working of fuel supply system in diesel engine
- Identify and select various components of fuel supply system is diesel engine.
- Test I.C engine.
- Interpret effect of various parameters on engine performance.
- Comprehend effect of automobile pollution on humans and methods to control pollution
- Explain the concept involved in specialized engine.

DETAILED CONTENTS

1. Combustion in I.C. Engines (10 hrs)

   Phenomenon of combustion in S.I. engine- phases of combustion, Turbulence, Abnormal combustion, Pre ignition and Detonation, Octane rating, Phenomenon of combustion in C.I. engines-phases of combustion. Methods of producing air movements namely squish and swirl, various types of combustion chambers for diesel engine, diesel knock, cetane rating

2. Fuel Supply System in Diesel Engine (12 hrs)

   2.1. Layout of fuel supply system in diesel engine and their types, Modern common rail direct injection system and individual pump system

   2.2 Fuel filters – primary and secondary, priming and fuel feed pumps. Fuel injection pumps –plunger and barrel type, distributor type. Fuel injectors, governing and types of governors. Supercharging of engines – function, advantages and disadvantages, types and location of superchargers, turbochargers

3. Specialized Types of Engine (6 hrs)

   3.1 Wankel engine
   3.2 Electrical / hybrid system/plug-in hybrid system
   3.3 CNG Engine

3.4 Homogeneous Charge Compression Ignition (HCCI) engine
3.5 Wheel hub motor

4. IC Engine Testing (6 hrs)

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

5. Performance of Engines (4 hrs)

5.1 Effect on engine performance due to atmospheric temperature & pressure, compression ratio, engine speed, dirt, desert, altitude and their remedial measures.
5.2 Performance curves

6. Emission Control (7 hrs)

Effects of pollutants from petrol and diesel engines on human beings and other materials, exhaust pollutants, sources of automotive emission, methods of emission control (by improvement in engine design and by exhaust gas treatment, positive crankcase ventilation, exhaust gas recirculation, catalytic converters for petrol and diesel engines, particulate filter selective catalytic reduction technique, NOX absorbers). Emission norms (Bharat Stage).

LIST OF PRACTICALS

1. Sketching and working of fuel supply system with in line pump in diesel engine
2. Testing of fuel injector (diesel) on test rig.
3. Phasing of fuel injection pump (Jerk type).
4. Calibration of fuel injection pump (Jerk type).
5. Servicing of turbocharger.
6. Find IP, BP, mechanical efficiency of multi-cylinder petrol engine by using Morse test.
7. Servicing of Exhaust Gas Recirculation (EGR).

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.

RECOMMENDED BOOKS

1 Singh, Dr. Kirpal, "Automobile Engineering Vol. II", Standard Publishers, Delhi.
2 Gupta, RB, "Automobile Engineering", Satya Parkashan, New Delhi.
3 Mathur, ML, and Sharma, "IC Engines", Dhanpat Rai and Sons, Delhi.
4 Singh, Dr. Kirpal, "Automobile Engineer (in Hindi)", Standard Publishers, Delhi.
5 Srinivasan, "Automotive Engine", TMH, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (Out of 50)
1	10	10
2	12	12
3	6	6
4	6	6
5	4	4
6	7	7
Total	**45**	**50**

4.3 STRENGTH OF MATERIALS

L	P
3	2

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.

LEARNING OUTCOMES

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

- 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.
- Determine the diameter of a shaft under combined bending and torsion.
- Calculate critical axial loads on column under different end constraints.
- Determine the various parameters in closed coil helical and laminated springs
- Determine conformance of given materials sample to the prescribed Indian standards.

DETAILED CONTENTS

1. Stresses and Strains (08 hrs)

   1.1. Basic assumptions; Concept of load, stress and strain

   1.2. Tensile compressive and shear stresses and strains

   1.3. Stress strain diagram

   1.4 Concept of Elasticity, Elastic limit, Hooke's law, Poisson's ratio, elastic constants and their relationship, limit of proportionality.

   1.5 Percentage elongation, factor of safety, strength and rigidity criteria of design

1.6 Strain energy due to direct stresses
1.7 Resilience, proof resilience and modulus of resilience
1.8 Stresses due to gradual, sudden and falling load.

2. Thin Cylindrical Shells

Longitudinal and circumferential stresses in seamless thin walled cylindrical shells.

3. Moment of Inertia (10 hrs)

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 (without 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

4. Bending Moment and Shearing Force (10 hrs)

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

5. Bending stresses (06 hrs)

5.1 Concept of Bending stresses
5.2. Theory of simple bending
5.3. Use of the equation $f/y = M/I = E/R$
5.4. Concept of moment of resistance
5.5. Bending stress diagram
5.6. Calculation of maximum bending stress in beams of rectangular, circular, and T section.
5.7 Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

6 Columns (08 hrs)

6.1. Concept of column, modes of failure
6.2. Types of columns
6.3. Buckling load, crushing load
6.4. Slenderness ratio
6.5. Factors effecting strength of a column
6.6 End restraints
6.7 Effective length
6.8 Strength of column by Euler Formula without derivation
6.9. Rankine Gordon formula (without derivation)

7. Torsion (10 hrs)

7.1. Concept of torsion- difference between torque and torsion.
7.2. Use of torque equation for circular shaft
7.3. Comparison between solid and hollow shaft with regard to their strength and weight.
7.4. Power transmitted by shaft
7.5 Concept of mean and maximum torque
7.6 Concept of Principal stresses, principal planes and max. shear stress.
7.7 Determination of shaft diameter under combined bending and torsion.

8. Springs (8 hrs)

8.1. Closed coil helical springs subjected to axial load - Stress deformation, Stiffness and angle of twist and strain energy, Proof Resilience
8.2 Determination of number of plates of laminated spring (semi elliptical type only)

LIST OF PRACTICALS

1. Tensile test on bars of Mild steel and Aluminium.
2. Bending tests 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 determine the stiffness of a helical spring and to plot a graph between load and extension.
6. Hardness test on different metals.

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

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems.
2. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

.

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	06
2	03	03
3	08	10
4	07	08
5	06	06
6	05	06
7	05	06
8	05	05
Total	**45**	**50**

4.4 CHASSIS, BODY AND TRANSMISSION - I

L	P
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, steering mechanism.

LEARNING OUTCOMES :

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

- Classify the vehicle
- Explain the function and working of clutch
- Explain the function and working of manual and automatic transmission
- Describe the functional and constructional features of final drive and its components and front axles.
- Comprehend steering geometry
- Explain the working and constructional features of steering system and their components

DETAILED CONTENTS

1. Chassis and Body (07 hrs)

Classification of vehicles, types of chassis, layout of conventional type of chassis, function and arrangement of major assemblies. Alternating arrangement used such as engine position, drive types, their merits and demerits., types of frame and body streamlining, cross members, brackets, materials of frame and body upholstery.

2. Clutch (09 hrs)

Necessity, function and requirements of clutch, types of clutch - single plate clutch, multi plate clutch, hydraulic power assisted and wet and dry plate clutch, clutch plate and lining material, Dual Mass flywheel.

Constructional details and working of centrifugal, semi centrifugal clutch, diaphragm clutch and fluid coupling.

3. Transmission (09 hrs)

Necessity, function and types of manual transmission- Sliding, constant mesh and synchromesh. Over drive, over running clutch, description and operation of transfer gear box. Common faults and remedies

Types of automatic transmission and their main components

Epicyclic gear box – construction, working and determination of speed ratio
Torque converter – construction, principle of working. Continuously variable transmission, Automated Manual Transmission, Dual Clutch Transmission

4. Final Drive (08 hrs)

Propeller shaft – function, construction details. Universal joints - functions and types. Types of final drive – hotchkiss drive, torque tube drive. Differential – principle, functions and its working. Rear axles – semi floating, three quarter floating. fully floating . Common faults and remedies, Limited Slip Differential

5. Front Axle (04 hrs)

Types – Stub double drop, fully dropped, load distribution, effect of braking on axle shape, steering head, Elliot and reverse elliot, steering knuckle.

6. Steering (08 hrs)

Steering mechanism, function, Davis and Ackerman's Principle of steering. Working and constructional details of steering gear, steering linkages, sector arm, center arm, drag link and tie rod steering stops. Front wheel geometry-castor, camber, steering axis inclination, toe in and toe out. Cornering force, cornering power and self-righting torque. Over steering and under steering. Power steering – necessity, types, Construction features and working of hydraulic and electronic power steering systems, Common steering systems troubles and remedies

LIST OF PRACTICALS

1. Demonstration and sketching of Heavy and Light vehicle chassis.
2. Identification and servicing of single plate and multi plate clutch.
3. Servicing of centrifugal clutch.
4. Servicing and overhauling of constant mesh and synchromesh gear box
5. Servicing of universal joints, slip joint and propeller shaft
6. Servicing of differential, adjustment of crown and pinion backlash.
7. Checking and adjustment of steering geometry, camber, caster, Toe-in, Toe-out, kingpin inclination.

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.

RECOMMENDED BOOKS

1. Singh, Dr. Kirpal, "Automobile Engineering Vol. I- II", Standard Publishers.
2. Narang, GBS, "Automobile Engineering", Khanna Publishers, Delhi.
3. Gupta, K M, "Automobile Engineering Vol I and II", Umesh Publishers, Delhi.
4. Gupta, R.B., "Automobile Engineering", Satya Prakashan, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (Out of 50)
1	7	8
2	9	10
3	9	10
4	8	9
5	4	4
6	8	9
Total	**45**	**50**

4.5 CAD IN AUTOMOBILE ENGINEERING

L	P
-	4

RATIONALE

Competency in CAD is essential for diploma holders in Automobile Engineering. Hence this subject is required.

LEARNING OUTCOMES :

After undergoing the subject, students will be able to:

- Apply basic CAD commands to develop 2D and 3D drawings of automotive components using AutoCAD.

DETAILED CONTENTS

1. Introduction to AutoCAD

1.1. Introduction to AutoCAD. Setting the drawing environment: Limits, Grid, Snap, Axis, Units, Ortho, Co- Ordinates ON, OFF Units and Color.

1.2. 2D Drawing entities – Point, Line, Arc, circle, Ellipse, Polygon, and Trace. Object Selection using Object Snap (OSNAP).

1.3. Editing commands: Selection of entities by different methods - copy, Move, Scale, Rotate, Fillet, Chamfer, and Mirror, Array-Polar, Rectangular. Measure, Divide, and Erase.

1.4. Drawing Display Methods: Zoom, Pan, and View.

1.5 Adding Texts and Dimensions: Text, Dimension-linear, continued, angular

1.6. Edit commands. Working on multiple layers, Layer concepts in AutoCAD -Various options with layer command - Hatch command - Creating line types, library and user made library.

1.7. Preparing the schematic drawing of a workshop building in one layer, the blocks of machines in another Layer and Electrical connection on another layer.

2. Drawing of 2D views of following automotive components using AutoCAD (Any Six sheets)
   - V belt pulley
   - Stepped cone pulley
   - Ball bearing
   - Sectional front view of screw jack
   - Spur gear
   - Poppet valve

- Wheel cylinder (sketch)
- Valve tappet
- Crank shaft
- Master cylinder
- Connecting rod
- Piston
- Semi-elliptic leaf spring
- Coil spring
- Internal expanding shoes brake (sketch)

3. Introduction to 3D features of AutoCAD

INSTRUCTIONAL STATREGY

1. Teachers should demonstrate use of AutoCAD, while teaching..
2. Emphasis should be given on dimensioning and layout of sheet.
3. Teacher should ensure use of IS Codes related to drawing.

Note: Uses, specifications, material and functions of above components should also be explained in the class.

RECOMMENDED BOOKS

1. Tickoo, Shyam, "AutoCAD", Dream Tech. Publication, Delhi.
2. "Computer aided drafting – Auto CAD", ISTE Nomogram, Delhi.

4.6 WORKSHOP TECHNOLOGY-II

L	P
3	6

RATIONALE

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Perform turning, step turning, taper turning, threading and knurling operation on lathe machine.
- Resharpen/grind single point tool.
- Select material and tool geometry for cutting tools on lathe.
- Perform drilling, reaming, counter boring, counter sinking and tapping operations on drilling machine.
- Explain the nomenclature of a drill
- Perform filing, cutting, Fitting and die tapping operations
- Perform keyway cutting and angular/step surface shaping on shaper.
- Explain geometry of single point tools, various types of lathe tools and tool materials.
- Explain uses of lathe accessories and different types of lathes.
- Explain boring operation, features of boring machine and boring tool.
- Explain the uses and features of jigs, fixtures, locating devices and clamping devices.
- Select cutting fluid for different materials and operations.
- Describe the features of various types of broaching machines.

DETAILED CONTENTS

1. Cutting Tools and Cutting Materials (06 hrs)

   1.1. 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, Description of insert bit type tool holders, insert grades & selection of insert bits.

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

2. Lathe (08 hrs)

   2.1 Principle of turning
   2.2 Description and function of various parts of a lathe

2.3 Classification and specification of various types of lathe
2.4 Drives and transmission
2.5 Work holding devices on lathe
2.6 Lathe tools: Parameters/Nomenclature and applications
2.7 Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning.
2.8 Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time.
2.9 Speed ratio, preferred numbers of speed selection.
2.10 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.
2.11 Brief description of capstan and turret lathe, comparison of capstan/Turret lathe, work holding and tool guiding devices in capstan and turret lathe.

3. Drilling (06 hrs)

3.1 Principle of drilling.
3.2 Classification of drilling machines and their description.
3.3 Various operation performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping.
3.4 Speeds and feeds during drilling, impact of these parameters on drilling, machining time.
3.5 Types of drills and their features, nomenclature of a drill
3.6 Drill holding devices.
3.7 Radial Drilling Machine: Construction, working principle and applications.
3.8 Types of reamers.

4. Boring (04 hrs)

4.1 Principle of boring
4.2 Classification of boring machines and their brief description.
4.3 Specification of boring machines.
4.4 Boring tools, boring bars and boring heads.
4.5 Description of jig boring machine.

5. Shaping and Planing (08 hrs)

5.1 Working principle of shaper and planer
5.2 Type of shapers
5.3 Type of planers
5.4 Quick return mechanism applied to shaper and planer machine.
5.5 Work holding devices used on shaper and planer
5.6 Types of tools used and their geometry.
5.7 Specification of shaper and planer .
5.8 Speeds and feeds in above processes.

6. Broaching (04 hrs)

6.1 Introduction
6.2 Types of broaching machines – Single ram and duplex ram horizontal type, vertical type pull up, pull down, push down. Continuous broaching and rotary broaching.
6.3 Elements of broach tool, broach tooth details – nomenclature, types, and tool material.

7. Jigs and Fixtures (05 hrs)

7.1 Importance and use of jigs and fixture
7.2 Principle of location
7.3 Locating devices
7.4 Clamping devices
7.5 Types of Jigs – Drilling jigs, bushes, template jig, plate jig, channel jig, leaf jig.
7.6 Fixture for milling, turning, welding, grinding
7.7 Advantages of jigs and fixtures

8. Cutting Fluids and Lubricants (04 hrs)

8.1 Function of cutting fluid
8.2 Types of cutting fluids
8.3 Degradation, replacement and disposal of cutting fluids. Testing of cutting fluids. Various hazards associated with the storage and use of cutting fluids.
8.4 Difference between cutting fluid and lubricant
8.5 Selection of cutting fluids for different materials and operations
8.6 Common methods of lubrication of machine tools.

PRACTICAL EXERCISES

Turning Shop

Job 1. Sharpening of single point turning tool on a Tool & Cutter grinder as per tool signature.
Job 2. Exercise of simple turning and step turning.
Job 3. Demonstration of grinding process on surface grinding machine
Job 4. Preparation of a composite job involving turning, taper turning, external thread cutting, knurling and parting-off.

Advance Fitting Shop

Job 1. Exercise on drilling, reaming, counter boring, counter sinking and taping
Job 2. Dove tail fitting in mild steel
Job 3. Radius fitting in mild steel
Job 4. Pipe threading with die

Machine Shop

Job 1. Prepare a V-Block up to ± 0.5 mm accuracy on shaper machine
Job 2. Exercise on key way cutting and spline cutting on shaper machine.
Job 3. Exercise on making a simple fixture for milling machine.

INSTRUCTIONAL STRATEGY

1. Teachers should lay emphasis in making students conversant with concepts and principles of manufacturing processes.
2. Focus should be on preparing jobs using various machines in the workshop.
3. Foreman 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.

RECOMMENDED BOOKS

1. Raghuwanshi, B.S., "Workshop Technology", Dhanpat Rai and Sons, Delhi.
2. Choudhry, SK, and Hajra, "Elements of Workshop Technology", Asia Publishing House.
3. Sharma, PC, "A Text Book of Production Engineering", S Chand and Company Ltd. Delhi
4. Rao, P N, "Manufacturing Technology Vol I, II and III", McGraw Hill Publication, Noida, UP.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	06
2	08	10
3	06	06
4	04	04
5	08	10
6	04	04
7	05	06
8	04	04
Tot1al	**45**	**50**

ENTREPRENEURIAL AWARENESS CAMP

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks. State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business
11. Preparation of Project Report

INDUSTRIAL TRAINING OF STUDENTS

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 6 weeks duration to be organised during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 50 and external assessment of 50 marks have been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity 15%
b) Initiative in learning new things 15%
c) Relationship with workers 15%
d) Industrial training report 55%