Jharkhand University of Technology
Ranchi, 834010

SCHEME OF INSTRUCTION AND SYLLABUS

For Diploma Program in
Automobile Engineering/Mechanical Engineering Automobile

(Effective from 2024-25)

Branch: Automobile Engineering/Mechanical (Automobile Engineering)

ENGINEERING MATHEMATICS

Subject Code: -BSC101 **(3-1-0)**

RATIONALE

Engineering Mathematics specification provides students with access to important mathematical ideas to develop the mathematical knowledge and skills that they will draw on in their personal and work lives. The course enable students to develop mathematical conceptualization, inquiry, reasoning, and communication skills and the ability to use mathematics to formulate and solve problems in everyday life, as well as in mathematical contexts. At this level, the mathematics curriculum further integrates the three content areas taught in the higher grades into three main learning areas: Algebra; Measurement of angles and Trigonometry and Calculus.

1. COURSE SKILL SET

Student will be able to:

1. Solve system of linear equations arise in different engineering fields
2. Incorporate the knowledge of calculus to support their concurrent and subsequent engineering studies
3. Adept at solving quantitative problems
4. Ability to understand both concrete and abstract problems
5. Proficient in communicating mathematical ideas
6. Detail-oriented

2. DETAILS OF COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets.

UNIT NO	Unit skill set (In cognitive domain)	Topics/Subtopics

UNIT-1 **MATRICES AND DETERMINANTS**	➢ Use algebraic skills which are essential for the study of systems of linear equations, matrix algebra and eigen values	1.1 Matrix and types 1.2 Algebra of Matrices (addition, subtraction, scalar multiplicationand multiplication) 1.3 Evaluation of determinants of a square matrix of order 2 and 3. Singular matrices 1.4 Cramer's rule for solving system of linear equations involving 2 and 3 variables 1.5 Adjoint and Inverse of the non- singular matrices of order 2 and 3 1.6 Characteristic equation and Eigen values of a square matrix of order 2

UNIT-2 **STRAIGHT LINES**	➢ Able to find the equation of a straight line in different forms ➢ Determine whether the lines are parallel or perpendicular	2.1 Slope of a straight line 2.2 Intercepts of a straight line 2.3 Intercept form of a straight line 2.4 Slope-intercept form of a straight line 2.5 Slope-point form of a straight line 2.6 Two-point form of a straight line 2.7 General form of a straight line 2.8 Angle between two lines and conditionsfor lines to be parallel and perpendicular 2.9 Equation of a straight line parallel to thegiven line 2.10 Equation of a straight line perpendicularto the given line
UNIT-3 **TRIGONOMETRY**	➢ Use basic trigonometric skills in finding the trigonometric ratios of allied and compound angles ➢ Able to find all the measurable dimensions of a triangle	3.1 Concept of angles, their measurement, Radian measure and related conversions. 3.2 Signs of trigonometric ratios in differentquadrants (ASTC rule) 3.3 Trigonometric ratios of allied angles(definition and the table of trigonometric ratios of standard allied angles say $90^0 \pm \Theta$, $180^0 \pm \Theta$, $270^0 \pm \Theta$ and $360^0 \pm \Theta$) 3.4 Trigonometric ratios of compoundangles (without proof) 3.5 Trigonometric ratios of multiple angles 3.6 Transformation formulae
UNIT-4 **DIFFERENTIAL CALCULUS AND APPLICATIONS**	Able to differentiate algebraic, exponential, trigonometric, logarithmic and composite functions Able to find higher order derivatives Understand and work with derivatives as rates of change in mathematical models Find local maxima and minima of a function	4.1 Derivatives of continuous functions in aninterval (List of formulae) 4.2 Rules of differentiation 4.3 Successive differentiation (up to secondorder) 4.4 Applications of differentiation
UNIT-5 **INTEGRAL CALCULUS AND APPLICATIONS**	➢ Understand the basic rules of integration and Evaluate integrals with basic integrands. 2. Identify the methods to evaluate integrands 3. Apply the skills to evaluate integrals representing areas and volumes	5.1 List of standard integrals and Basic rulesof integration 5.2 Evaluation of integrals of simplefunction and their combination 5.3 Methods of integration 5.4 Concept of definite integrals 5.5 Applications of definite integrals

4. DETAILED COURSE CONTENT

UNIT NO AND NAME	DETAILED COURSE CONTENT	CO	PO
1 MATRICES AND DETERMINANTS	Definition and types of matrices		
	Algebra of Matrices (addition, subtraction and scalar multiplication) problems		
	Multiplication of Matrices(problems)		
	Evaluation of 2x2 ,3x3 determinants and Singular matrices and problems in finding unknown variable		
	Cramer's rule to solve system of linear equation with 2 and 3 variables		
	Cramer's rule to solve system of linear equation with 2 and 3 variables.problems		
	Minors, Cofactors of elements of square matrices of order 2 and 3		
	Adjoint of a square matrix(2x2 and 3x3),Inverse of a non singular square matrix		
	Adjoint of a square matrix(2x2 and 3x3),Inverse of a non singular square matrix and problems		
	Characteristic equation and eigen values of a 2x2 matirx and problems		
2 STRAIGHTLINES	Slope of the straight line(provided with inclination and two points on the line as well) and problems		
	Intercepts of a straight line and problems		
	Intercept form of a straight line and problems		
	Slope-intercept form of a straight line and problems		
	Slope-point form of the straight line and problems		
	Two-point form of a straight line and problems		
	General form of a straight line.problems on finding slope and intercepts.		
	Angle between two straight lines and conditions forthe lines to be parallel and perpendicular and problems		
	Equation of a line parellel to the given line and problems		
	Equation of a line perpendicular to the given line.problems		

UNIT-3 TRIGONOMETRY	Concept of angles and their measurement. Radian measures and related conversions (degree to radian and vice-versa) and problems		
	Signs of trigonometric ratios in different quadrants (ASTC rule)		
	Trigonometric ratios of allied angles (definition andthe table of trigonometric ratios of standard allied angles say $90^0 \pm \Theta$, $180^0 \pm \Theta$, $270^0 \pm \Theta$ and $360^0 \pm \Theta$)		
	Problems on allied angles. (proving identities)		
	Problems on allied angles. (Finding values of x in an identity)		
	Trigonometric ratios of compound angles (without proof)		
	Trigonometric ratios of multiple angles (sin2A, cos2A, tan2A, sin3A, cos3A and tan3A)		
	Problems on multiple angles sin2A, cos2A, tan2A, sin3A, cos3A and tan3A		
	Transformation formulae (without proof) as sum to product. (Simple problems)		
	Transformation formulae (without proof) as productto sum. (Simple problems)		
4 DIFFERENTIAL CALCULUS AND	Definition of a derivative of a function. Listing the derivatives of standard functions. (Algebraic, trigonometric, exponential, logarithmic and inverse trigonometric functions)		
	Addition and subtraction rule of differentiation and problems		
	Product rule and quotient rule of differentiation and problems		
	Product rule and quotient rule of differentiation and problems		
	Composite functions and their derivatives. (CHAIN RULE)		
	Composite functions and their derivatives. (CHAIN RULE). Problems		
	Successive differentiation up to second order		

	Slope of the tangent and normal to the given curve and their equations and problems		

	Rate measure: velocity and acceleration at a point of time and problems		
	Local Maxima and Minima of a function		
	Local Maxima and Minima of a function. Problems		
5 INTEGRAL CALCU INTEGRAL CALCULUS AND APPLICATIONS	Definition of an indefinite integral. Listing the Integrals of standard functions. (Algebraic, trigonometric, exponential, logarithmic and inverse trigonometric functions)		
	Rules of Integration. Evaluation of integrals with simple integrands and their combinations		
	Rules of Integration. Evaluation of integrals with simple integrands and their combinations. Problems		
	Evaluation of integrals with simple integrands and their combinations. Problems		
	Evaluation of integrals by Substitution method		
	Evaluation of integrals by Integration by parts		
	Evaluation of integrals by Integration by parts. Problems		
	Definition of definite integrals and their evaluation		
	Evaluation of Definite integrals. Problems		
	Area enclosed by the curves by integral method		
	Volume generated by the curve rotated about an axisby integral method		

5. SUGGESTED LEARNING RESOURCES:

Sl. No.	Author	Title of Books	Publication/Year
1	B.S. Grewal	Higher Engineering Mathematics	Khanna Publishers, New Delhi,40th Edition,2007
2	G. B. Thomas, R. L.Finney	Calculus and Analytic Geometry	Addison Wesley, 9th Edition, 1995
3	S.S. Sabharwal, Sunita Jain, Eagle Parkashan	Applied Mathematics, Vol. I & II	Jalandhar.
4	Comprehensive Mathematics	Comprehensive Mathematics Vol. I & II	Laxmi Publications, Delhi
5	ReenaGarg &Chandrika Prasad	Advanced Engineering Mathematics	Khanna Publishing House, New Delhi

Engineering Chemistry

Subject Code: - BSC103 (3-0-0)

RATIONALE:

Chemistry is a basic science subject which is essential to all engineering courses. It gives knowledge of engineering materials, their properties, related applications & selection of materials for engineering applications.

Due to technological progress there are hazardous effects on environment & human life. The core knowledge of environmental effects will bring awareness in students about the precautions & preventions to be taken to reduce the ill effects.

This subject will generate curiosity of carrying out further development in engineering fields.

OBJECTIVES: The student will be able to:

1. Draw the orbital configuration of different elements.
2. Represent the formation of molecules schematically.
3. Describe the mechanism of electrolysis.
4. Identify the properties of metals & alloys related to engineering applications.
5. Identify the properties of non metallic materials, related to engineering applications.
6. Compare the effects of pollutants on environments & to suggest preventive measures &safety.

Atomic Structure

Definition of Atom, Fundamental Particles of Atom – their Mass, Charge, Location, Definition of Atomic no, Atomic Mass no., Isotopes & Isobars, & their distinction with suitable examples, Bohr's Theory, Definition, Shape of the orbitals & distinction between Orbits & Orbitals, Hund's Rule, Filling Up of the Orbitals by Aufbau's Principle (till Atomic no. 30), Definition & types of valency (Electrovalency & Covalency), Octet Rule, Duplet Rule, Formation of Electrovalent & Covalent Compounds e.g. Nacl, $CaCl_2$, MgO, $AlCl_3$, CO_2, H_2O, Cl_2, NH_3, C_2H_4, N_2, C_2H_2. Distinction between electrovalent & covalent compounds.

Electrochemistry

Definition & differentiation of Atom, Ion. Definition of Ionisation & Electrolytic dissociation, Arrhenius Theory of Ionisation,Degree of Ionisation & factors affecting degree of ionization. Significance of the terms involved in Electrolysis- Such as Conductors, Insulators , Dielectrics, Electrolyte, Non Electrolyte, Electrolysis, Electrolytic Cell, Electrodes. Mechanism of Electrolysis – Primary & Secondary Reactions at Cathode & Anode, concept of electrode potential such as reduction potential & oxidation potential. Electrochemical Series for Cations & Anions, Electrolysis of $CuSO_4$ Solution by using Cu Electrode & Platinum Electrode, Electrolysis of NaCl solution & fused NaCl by using carbon electrode, Faraday's first & second law of Electrolysis & Numericals, Electrochemical Cells & Batteries, Definition, types such as Primary & Secondary Cells & their examples.Construction, Working & Applications of Dry Cell & Lead – Acid Storage Cell, Applications of Electrolysis such as Electroplating & Electro refining, Electrometallurgy & Electrotyping.

Metals & Alloys

1. Metals

Occurrence of Metals, Definition of Metallurgy, Mineral, Ore,Gangue, Flux & Slag, Mechanical Properties of metals such as Hardness, Toughness, Ductility, Malleability, Tensile strength, Machinability, Weldability, Forging, Soldering, Castability. Stages of Extraction of Metals from its Ores in detail i.e. Crushing, Concentration, Reduction, Refining. Physical Properties & Applications of some commonly used metals such

as Fe, Cu, Al, Cr, Ni, Sn, Pb, Zn, Co, Ag, W.

2. Alloys

Definition of Alloy, Purposes of Making alloy. Preparation Methods, Classification of Alloys such as Ferrous & Non Ferrous & their examples. Composition, Properties & Applications of Alnico, Duralumin, Dutch Metal, GermanSilver / Nickel Silver, Gun Metal, Monel metal, Wood's Metal,
Babbittmetal.

Non Metallic Materials

1. Plastics

Definition of Plastic, Formation of Plastic by Addition & Condensation Polymerisation by giving e.g. of Polyethylene & Backelite plastic Respectively, Types of Plastic, Thermosoftening & Thermosetting Plastic, with Definition, Distinction & e.g., Compounding of Plastics – Resins, Fillers, Plasticizers, Acceleraters, Pigments & their examples, Engineering Applications of Plastic based on their properties.

2. Rubber

Natural Rubber: Its Processing, Drawbacks of Natural Rubber, Vulcanisation of Rubber with Chemical Reaction.

Synthetic Rubber: Definition, & e.g, Distinction Between natural & synthetic rubber. Properties of rubber such as elasticity, tack, abrasion resistant,stress & strain and related engg.application.

3. Thermal Insulating Materials

Definition & Characteristics of Thermal insulators.

Preparation, Properties & Applications of Thermocole & glasswool. Properties & Applications of Asbestos, Cork.

Environmental Effects (Awareness Level)

1. Pollution & Air pollution

Definition of pollution & pollutant, Causes of Pollution, Types of Pollution - Air & Water Pollution.

Air Pollution

Definition, Types of Air pollutants their Sources & Effects, Such as Gases, Particulates, , Radio Active Gases, Control of Air Pollution, Air Pollution due to Internal Combustion Engine& Its Control Methods, Deforestation their effects & control measures. Causes , Effects & control measures of Ozone Depletion & Green House Effects**.**

2. Water Pollution & Waste

Definition, Causes & Methods of Preventing Water Pollution, Types of Waste such as Domestic Waste, Industrial Waste, their Physical & Biological Characteristics, Concept & significance of BOD, COD, Biomedical Waste & E – Waste, their Origin, Effects & Control Measures. Preventive Environmental Management (PEM) Activities.

Engineering Chemistry Lab

Subject Code: - BSC103P **(0-0-2)**

01 – 07 Qualitative Analysis of **Seven Solutions,** Containing One Basic & One Acidic Radical Listed below.

Basic Radicals

Pb^{+2}, Cu^{+2}, Al^{+3}, Fe^{+2}, Fe^{+3}, Cr^{+3}, Zn^{+2}, Ni^{+2}, Ca^{+2}, Ba^{+2}, Mg^{+2}, K^{+}, NH_4^{+}.

Acidic Radicals

Cl^{-}, Br^{-}, I^{-}, CO_3^{-2}, SO_4^{-2}, NO_3^{-}.

08 To Determine E.C.E. of Cu by Using $CuSO_4$ Solution & Copper Electrode

09 To Determine the % of Fe in the Given Ferrous Alloy by $KMnO_4$ Method.

10 To Prepare a Chart Showing Application of Metals like Fe, Cu, Al, Cr, Ni,Sn, Pb, Co.

11 To Prepare Phenol Formaldehyde Resin (Backelite)

12 To Determine Carbon Monoxide Content in Emission from Petrol Vehicle.

13 To Determine Dissolved Oxygen in a Water Sample.

Learning Resources:

Reference Books:

Sr. No.	Author	Name of the book	Publisher
01	Jain & Jain	Engineering Chemistry	Dhanpat Rai and Sons
02	S. S. Dara	Engineering Chemistry	S. Chand Publication
03	B. K. Sharma	Industrial Chemistry	Goel Publication
04	S. S. Dara	Environmental Chemistry & Pollution Control	S. Chand Publication
05	Vedprakash Mehta	Polytechnic Chemistry	Jain brothers

Engineering Physics

Subject Code: - BSC102 **(3-0-0)**

RATIONALE:

Engineering is entirely meant for comfort of mankind. It includes varieties of disciplines like Mechanical Engg., Electrical Engg., Civil Engg., Electronics Engg., Computer Engg., etc. Theoverall growth of these disciplines is based on developments in fundamental sciences and their conceptual learning too.

For sustainable socio-economic development of the country, comprehensive researchtechniques in science and engineering are required. Regarding any problem to identify, understand and solve, the decision based on scientific facts and results is must.

Engineering, being the science of measurement and design, has been offspring of Physics that plays the primary role in all professional disciplines of engineering. The different streams of Physics like Optics, Acoustics, Dynamics, Semiconductor Physics, Surface Physics, Nuclear physics, Energy Studies, Materials Science, etc. provide **Fundamental Facts, Principles, Laws, and Proper Sequence of Events** to streamline Engineering knowledge.

OBJECTIVES: Student will be able to:

- Measure given dimensions by using appropriate instruments accurately.
- Select proper measuring instrument on the basis of range, least count & precision requiredfor measurement.
- Select proper material for intended purpose by studying properties of materials.
- Identify good & bad conductors of heat.
- Analyze relation among pressure, volume and temperature of gas & to interpret the results
- Identify the effect of interference between light waves.
- Identify properties of laser light and photoelectric effect for engineering applications.
- Identify, analyze, discriminate and interpret logical sequence of field problems with thestudy of physics.

Course Content-

UNITS AND MEASUREMENTS

1) Need of measurement and unit in engineering and science, definition of unit , requirements of standard unit, systems of units-CGS,MKS and SI, fundamental and derived quantities and their units
2) Least count and range of instrument, least count of vernier caliper, micrometer screw gauge and sphereometer,
3) Definition of accuracy, precision and error, estisimation of errors -absolute error, relative error and percentage error, rules and identification of significant figures.

(Numericals on percentage error and significant figures)

GENERAL PROPERTIES OF MATTER

2.1 Elasticity

Deforming force, restoring force, elastic and plastic body,stress and strain with their types. elastic limit, Hooke's law,Young's modulus, bulk modulus, modulus of rigidity andrelation between them (no derivation), stress strain diagram.behavior of wire under continuously increasing load, yield point, ultimate stress, breaking stress, factor of safety.

(Numericals on stress, strain and Young's modulus)

2.2 Surface Tension.

Molecular force, cohesive and adhesive force, Molecular range , sphere of influence, Laplace's molecular theory, Definition of surface tension and its S.I.unit,angle of contact,capillary action with examples, shape of meniscus for waterand mercury, relation between surface tension , capillary riseand radius of capillary (no derivation),effect of impurity andtemperature on surface tension.

(Numericals on relation between surface tension, capillary rise and radius)

2.3 Viscosity

Fluid friction, viscous force, Definition of viscosity, velocitygradient, Newton's law of viscosity, coefficient of viscosityand its S.I. unit, streamline and turbulent flow with examples, critical velocity, Reynolds's number and its significance, free fall of spherical body through viscous medium (no derivation), up thrust force, terminal velocity, Stokes law (statement and formula).

(Numericals on coefficient of viscosity, Reynoldsnumber and Stoke's formula)

HEAT

3.1 Transmission of heat and expansion of solids

Three modes of transmission of heat -conduction, convection and radiation, good and bad conductor of heatwith examples, law of thermal conductivity, coefficient ofthermal conductivity and its S.I. unit, Definition of linear,aerial and cubical expansion and relation between them.(noderivation)

(Numericals on law of thermal conductivity, and coefficientsof expansions)

3.2 Gas laws and specific heats of gases

Boyle's law, Charle's law, Gay Lussac's law, absolute zero temperature, Kelvin scale of temperature, general gas equation (statement only), specific and universal gas constant, Two specific heats of gas and relation between them(no derivation),Isothermal and adiabatic expansion of gas.

(Numericals on gas laws and specific heats)

LIGHT, LASER and SOUND

4.1 Properties of light

Reflection, refraction, snell's law, physical significance of refractive index, definition of dispersion, polarization and diffraction of light along with ray diagram, principle of superposition of waves, interference of light, constructive and destructive interference.

(Numericals on refractive index)

4.2 LASER

Properties of laser, spontaneous and stimulated emission,population inversion, optical pumping, construction and working of He-Ne laser.

4.3 Sound

Definition of wave motion, amplitude, period, frequency, and wavelength, relation between velocity, frequency and wavelength , equation of progressive wave (no derivation), longitudinal and transverse wave, definition of stationary wave , node and antinode, forced and free vibrations, definition of resonance with examples, formula for velocityof sound with end correction (no derivation)

(Numericals on relation $v = n\lambda$ and resonance)

MODERN PHYSICS

5.1 Photo electricity

Concept of photon**,** Plank's hypothesis, properties of photon, photo electric effect, Characteristics of photoelectric effect, work function, Einstein's photoelectric equation(no derivation), photoelectric cell-construction ,working and applications.

(Numericals on Energy of photon, work function,photoelectric equation)

5.2 X-rays

Introduction to x-rays, types of x-ray spectra-continuous andcharacteristics, production of x-rays using Coolidge tube, minimum wavelength of x-rays, properties of x-rays, engineering, medical and scientific applications.

(Numericals on minimum wavelength of x-rays)

Engineering Physics Lab

Subject Code: - BSC102P **(0-0-2)**

List of Experiments

1. To know your Physics Laboratory.
2. To use Vernier Caliper for the measurement of dimensions of given object.
3. To use Micrometer Screw Gauge for the measurement of dimensions (Length,Thickness, Diameter) of given object.
4. To verify Hooke's Law by Searle's method and to calculate Young's modulus ofelasticity of steel wire.
5. To study capillarity phenomenon and to verify that the height of liquid in capillary is inversely proportional to the radius of capillary.
6. To determine coefficient of viscosity of given fluid (Glycerin) using Stoke's Method.
7. To calculate the Linear Thermal coefficient of expansion for copper by using Pullinger's apparatus.
8. To Verify Boyle's law and to find out atmospheric pressure in the laboratory usinggraph.
9. To determine the velocity of sound by using resonance tube.
10. To verify characteristics of photoelectric cell.
11. Use of Thermocouple as a thermometer for the measurement of unknown temperature(Boiling Point of Water)
12. To determine the divergence of He-Ne laser beam.

Reference Books:

Sr. No.	Name of book	Author	Publisher & Address
1.	Physics-I	V. Rajendran	Tata McGraw- Hill raw- Hillpublication, New Delhi
2.	Applied physics	Arthur Beiser	Tata McGraw- Hill raw- HillPublication, New Delhi
3.	Engineering Physics	by R.K.Gaur and S.L.Gupta	Dhanpat Rai Publication,New Delhi.
4.	Fundamentals of Physics	Resnick ,Halliday & Walker	Wiley India Pvt. Ltd.

MECHANICAL SCIENCE & ENGINEERING

Subject Code: - MEC101 (3-0-0)

RATIONALE:

Mechanical Sciences and Engineering play a critical role in manufacturing technologies, from cars to airplanes to refrigerators. It applies the principles of engineering to the design, analysis, manufacturing and maintenance of machines. It paves the way to have a lucrative career that benefits the society. Therefore, an engineering diploma student must be conversant with the behavior and mechanism of the materials from the point of view of reliability, sustainability and performance of the product. The study of basic concepts of mechanical sciences and engineering will help the students in understanding engineering subjects where the emphasis is laid on the application of these materials.

1. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through variousteaching – learning experiences

i. Select engineering materials based on properties, behavior and environmental effect for givenengineering application.

ii. Explore different shafts, keys, couplings, bearings and illustrate various types of drives and fasteningsused in engineering/automobile application.

iii. Understand different engine terminologies and working of 2-stroke and 4-storke engine used in anautomobile.

2. DETAILS OF COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill sets for achieving CO toattain identified skill sets

UNIT NO.	Unit skill set (In cognitive domain)	Topics/Subtopics
UNIT-1 **ENGINEERING MATERIALS AND THEIR PROPERTIES**	1. Classify engineering materials with their properties. 2. Identify and compare ferrous and nonferrous materials. 3. Select relevant cast iron for the given job with justification. 4. Select relevant steel for the given application. 5. Describe the properties and application of the given copper alloy. 6. Compare and explain different heat treatment processes. 7. Select relevant Heat treatment process for the given material with justification.	1.1 Classification of engineering materials. 1.2 Selection of materials for engineering purposes. 1.3 Physical properties of metals. Mechanical properties of metals. 1.4 Ferrous metals - Cast Iron- Types of Cast Iron- Alloy cast iron. Effect of impurities on cast iron. 1.5 Steel - Effect of impurities on steel- alloy steels. Stainless Steel - Types of stainless steel. 1.6 Non-ferrous Metals - Types- Aluminum - Aluminum alloys. 1.7 Copper - Copper Alloys, types. Bearing Metals – Types, properties. 1.8 Non-metallic Materials - Rubber, glass, ceramics, polymers, composite materials - properties and application of each. 1.9 Heat treatment - Aim of heat treatment. Heat treatment techniques. 1.10 Annealing and its types. Normalising, hardening, tempering. 1.11 Martempering, austempering, hardenability, surface hardening. 1.12 Carburizing, nitriding, cyaniding, flame hardening and induction hardening.

UNIT-2 **SHAFTS, KEYS, COUPLINGS AND BEARINGS**	1 Describe the materials used for shafts and type of shafts used for specific application. 2 Describe the applications of different types of keys used in automobile application. 3 Explain different applications of couplings used for specific application. 4 Describe the properties and application of the given bearing material. 5 Demonstrate different types of bearings used in automobile.	2.1 Introduction to shafts - Material used for shafts. Types of Shafts. Standard sizes of transmission shafts. 2.2 Introduction to Keys - Types of Keys – Sunk keys - Types of Sunk keys. 2.3 Saddle keys, tangent keys, round keys Construction and working of each type with neat sketch. 2.4 Woodruff keys and splines –Construction and working of each type with sketch. 2.5 Introduction to shaft couplings –Requirements of a good shaft coupling - Types of shaft couplings. 2.6 Sleeve or Muff couplings - Construction and working with sketch. 2.7 Flange Coupling - Construction and working with sketch. 2.8 Introduction to bearings. Classification of bearings. Types of sliding contact bearings with advantages and disadvantages. 2.9 Shell bearings - Roller contact bearings - Advantages and disadvantages. 2.10 Ball bearings - Construction and working. 2.11 Roller bearings - Construction andworking. 2.12 Thrust bearings - Construction and working.
UNIT-3 **BELT DRIVES, CHAIN DRIVES AND GEAR DRIVES**	1. Select a belt drive system for specific application. 2. Calculate the velocity ratio for the given belt drive. 3. Describe the application of chain drive in automobile. 4. Conceptualize with sketches the different gear trains used.	3.1 Introduction to belt drives - Selection of beltdrives - types of belt drives - types of belts-Materials used for belts. 3.2 Types of flat belt drives - open belt drive, crossed or twist belt drive, belt drive with idler pulleys and compound belt drive. 3.3 Velocity ratio of belt drive - Slip and creep of belt. V- belt drives 3.4 Cross section of a V-belt with sketch - advantages and disadvantages of V-belt over flat belt drives. 3.5 Chain drives - Advantages anddisadvantages. 3.6 Gears or Toothed wheels- advantages and disadvantages of gear drives. 3.7 Types of gears- spur gears, bevel gears, helical gears, worm and worm wheel, rack and pinion with simple sketches. 3.8 Velocity ratio in gear drive. 3.9 Gear trains- Types of gear trains-, simple and compound gear trains 3.10 Simple line sketch-speed ratio or velocity ratio of simple and compound gear trains.
UNIT-4 **FASTENERS**	1. Distinguish between temporary and permanent fasteners with specific applications.	4.1 Introduction to Fasteners - Types- Temporary and permanent. Screwed joint- advantages and disadvantages of screwed joint. 4.2 Screw thread terminology or terms used in screw threads - Types of screw fastenings. 4.3 Locking devices - Types of locking devices

	2. Analyze the different types of locking devices used in automobiles. 3. Distinguish between Lap joint and Butt joint with their specific applications.	or lock nuts with sketches. 4.4 Permanent fastenings - Types of rivetedjoints. 4.5 Lap joint - types- single riveted –double riveted-simple sketch. 4.6 Butt joint-types-single strap-double strapbutt joint with simple sketch.
UNIT-5 **ENGINE TERMINOLOGIES**	1. Compare EC and IC engines with specific applications. 2. Discuss engine terminologies used in different vehicles. 3. Differentiate between speed and torque with their units. 4. Explain BP, IP, FP & Mechanical efficiency.	5.1 Definition - types - IC and EC engines-comparison. 5.2 Engine terminologies - bore – stroke– TDC – BDC - mean effective pressure. 5.3 Clearance volume - swept volume - totalvolume - compression ratio. 5.4 Mean effective pressure – indicated power –brake power - friction power. 5.5 Engine speed engine torque, specific fuel consumption. 5.6 Brake thermal efficiency, indicated thermal efficiency and mechanical efficiency.
UNIT-6 **I.C. ENGINES**	1. Classify IC engines based on different parameters. 2. Demonstrate working of 2-stroke SI engine using section model. 3. Demonstrate working of 2-stroke CI engine using section model. 4. Demonstrate working of 4-stroke SI engine using section model. 5. Demonstrate working of 4-stroke CI engine using section model. 6. Explain the advantages of 2-stroke and 4-stroke engines considering specific example.	6.1 Classification of IC engines with respect todifferent parameters. 6.2 Two stroke SI Engine - Construction and working. 6.3 Four stroke SI Engine - Construction andworking. 6.4 Two stroke & Four stroke CI engines - construction – working. 6.5 Comparison of SI and CI engines. 6.6 Comparison of Two stroke and Four stroke engines.

SUGGESTED LEARNING RESOURCES: A. List ofBooks: S. No. Author Title of Books Publication/Year

1 R.S.Khurmi J.K.Gupta A Textbook of Machine Design S. Chand & Co
2 R.S.Khurmi J.K.Gupta Theory of Machines S. Chand & Co
3 Dr. Kirpal Singh Automobile Engineering vol 2 Standard publishers Distributors
4 Mathur &Sharma I C Engines Danapat Rai & Sons
5 V. Ganeshan I C Engines Tata McGraw-Hill
6 K.R.Gopalkrishana Mechanical engineering Science
7 K.R.Gopalkrishana Machine Drawing
8 Anil chikara Automobile Engineering Vol I Satya Prakashan
9 K.M.Gupta Automobile Engineering Vol I Umesh publications
10 Er.A.K.Babu Er.Aj itpal Singh Automobile Engineering S. Chand & Co

Engineering Workshop

Subject Code: -MEC101P **(0-0-3)**

1. Identify fire extinguisher according to their specification.
2. Perform mock drill session in group of minimum 10 students for extinguishing fire.
3. Identify different tools used in workshop.
4. Prepare job using following operations: part 1 a. Marking operation as per drawing b. punching operation as per drawing c. Filing operation as per drawing d. sawing operation as per drawing e. drilling operation as per drawing f. tapping operation as per drawing.
5. Prepare T joint pipe fitting job as per given drawing (individually).
6. Prepare elbow joint pipe fitting job as per given drawing (individually).
7. Prepare bill of material for given pipeline layout (individually).
8. Practice different safety rules in welding shop as per given instruction.
9. Prepare lap joint using gas welding as per given drawing (individually).
10. Prepare butt joint using gas welding as per given drawing (individually).
11. Prepare utility job (like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) Fabrication operation involve measuring, marking, cutting, edge preparation, welding.
12. Prepare sheet metal utility job using following operations a. Cutting and Bending b. Edging c. End curling d. Lancing e. Soldering f. Riveting.
13. Draw sketches of various ancient tools.

Suggested Learning Materials / Books

1. Gupta, J.K.; Khurmi, R.S., A Textbook of Manufacturing Process (Workshop Tech.), S.Chand and Co. New Delhi ISBN:81-219-3092-8.
2. Hajra; Choudhary, Elements of Workshop Technology, Media Promoters and Publishers Mumbai, 2009, ISBN: 10-8185099146.
3. Sarathe, A.K., Engineering Workshop Practice, Khanna Book Publishing CO(P) LTD, New Delhi, ISBN No. 978-93-91505-51-6.
4. Raghuwansi, B.S; Workshop Technology, Dhanpat Rai & Co.

IT SKILLS

Subject Code: -CSE101P **(0-0-3)**

1. RATIONALE

Information Technology is crucial to the majority of the business and has a great influence oninnovation and engineering. Every branch of engineering and every organization opt for computers and IT skills for business automation, communication/connectivity, resource planning, work automation and securing information etc. All engineering diploma students must be conversant with the basic IT skills which empower them to learn new technologies, adapt to changes, businessdevelopment, communication etc.

2. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences.

Perform jobs related to web design and maintenance, business process automation tool management, cyber security and safety and program assistant.

3. DETAILS OF COURSE CONTENT

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

UNIT NO	Topics/Sub topics	Unit skill set/Learning outcomes (In cognitive domain)
1	**UNIT 1 - INTRODUCTION TO BASICS OF CODING**	
	a) Introduction to computer programming b) Algorithms –With sufficient examples c) Flowcharts – With sufficient examples d) Execute simple programs **Note: Below listed or any other suitable online/offline coding platforms should be used to demonstrate and provide coding experience to students.** **a. https://scratch.mit.edu/**	1. Understand computer programming 2. Create and write Algorithm for programmable problems. 3. Design Flowchart for programmable problems. 4. Develop simple Android application.

	b. https://studio.code.org/projects Suggested programs are listed in Table 1 e) Introduction to Application development **f)** Simple android application development (No knowledge of programming language is required). **Note:** ***i. The purpose of application development is to ignite and promote programming skills.*** ***ii. Application development should be done using any App builder platforms such as*** ***iii. MITApp Inventor: https://appinventor.mit.edu/*** ***iv. Thunkable: https://thunkable.com/*** ***v. ibuildapp: https://ibuildapp.com/*** ***vi. The student should be introduced to the android application development environment for further research and learninghttps://developer.android.com/*** g) Activity: create a simple Android application (Unique for each student) publish on the learning management system.	
2	**UNIT 2 - DESIGN AND DEVELOP WEB PAGES**	
2	a) Basic web technologies ▪ Browser ▪ Web –Server ▪ Client-Server Model ▪ URL ▪ SEO techniques ▪ Domain names and domain name system. b) Creating Web-pages with HTML5 - Static	1. Understand and examine basicweb technologies 2. Creating static web pages 3. Formatting Webpages with cascading style sheets (CSS) 4. Creating Dynamic web pageswith JavaScript

	web pages. ▪ Introduction, Editors ▪ Tags, Attributes, Elements, Headings ▪ Links, Images, List, Tables, Forms ▪ Formatting, Layout, Iframes. 2.3 Formatting web pages with style sheets (CSS3). ▪ Introduction to CSS ▪ Inline CSS, Internal CSS, Classes and IDs ▪ div, Color, Floating, Positioning ▪ Margins, Padding, Borders ▪ Fonts, Aligning Text, Styling Links 2.4 Creating a web page dynamic using JavaScript. ▪ Dynamic web page and Introduction to JS ▪ Basic syntax ▪ Functions ▪ Events Note: Refer https://www.w3schools.com **2.6** Creating dashboards in websites. **2.6 Activity: Personal website design and launch with a free platform or Create a Blogging website.** ▪ **Online platforms (Learning and executing)** ▪ **https://www.w3schools.com/** ▪ **https://studio.code.org** ▪ **https://www.khanacademy.org** **Note:** **1) The student must be introduced to website development platforms - worldpress.com.** **2) The student must be made familiar**	5. Creating and launching dashboard based personalwebsite.

	with launching websites . Certification available: • HTML - W3schools • CSS - W3schools • JavaScript - W3schools	
3	**UNIT 3 -BUSINESS PROCESS AUTOMATION/ERP**	
3	6.2 Introduction to business process automation. 6.3 Organization structure and functions composition-Properties and applications ▪ Structure ▪ Types ▪ Functional Units **Note: Students should be made familiar with organization, types and components of a big enterprise to make him understand the working of organization keeping him as part of org.** 6.4 Workflows ▪ Introduction ▪ Components ▪ Use and use cases **Note: Use free and open-source platform to demonstrate and create workflows.** **Example:** **https://airflow.apache.org/** **https://taverna.incubator.apache.org/** **https://trello.com/** **https://www.processmaker.com/** 6.5 Enterprise resource planning ▪ History ▪ Evolution ▪ Uses of ERP ▪ ERP software tools.	1. Identify and examine the needsof business process automation. 2. Understand Organization structure and functions 3. Create and use workflows 4. Use Enterprise resource planning in workplace.

	Note: The student should be introduced into Enterprise resource planning software tools to understand importance of ERP. **Examples:** ▪ **https://erpnext.com/** ▪ **www.bitrix24.com** ▪ **https://www.odoo.com/** **3.5 Activity:** ▪ **Project plan for summer internship - use open source ERP Software** ▪ **Identify different components of nearby organization with recourse plan and workflow design.** ▪ **Identify types of ERP software available with their market share.**	
4	**UNIT 4 - INTRODUCTION TO CLOUD AND IOT CONCEPTS**	
	4.1 Fundamentals of cloud 4.2 Cloud service models ▪ IaaS (Infrastructure-as-a-Service) ▪ PaaS (Platform-as-a-Service) ▪ SaaS (Software-as-a-Service) 4.3 Cloud deployment types ▪ Public, ▪ Private, ▪ Hybrid ▪ Community Cloud 4.4 Cloud services: ▪ Google Drive - file storage and synchronization service developed by Google; ▪ Google docs- bring your documents to life with smart editing and styling tools to help you easily format text and paragraphs; ▪ Google Co-lab (Usage of Jupyter Notebook): *Colab* notebooks allow you to combine	1. Understand Cloud concepts 2. Identify and use Cloud services 3. UnderstandIoT concepts 4. Identify IoT applications

	executable code and rich text in a single document, along with images, HTML, LaTeX, and more. ▪ Google App Engine: Google App Engine is a Platform as a Service and cloud computing platform for developing and hosting web applications in Google-managed data centers. Applications are sandboxed and run across multiple servers. **Note: Above cloud services are not compulsory for all branches; teacher can recommend other cloud service based on need of engineering branch.** 4.5 Working of IoT and IoT components (Only brief introduction and demonstration through videos) 4.6 Explain concept of Internet of Things with examples ▪ Smart home ▪ Smart city ▪ Smart farming **Note:** **a. Teacher can also select specific area of work where Things (autonomous computing devices) could be interconnected over TCP/IP to establish IoT.** **b. The students should be introduced to the IoT environment for further research and study**. **Example:** ▪ **https://www.raspberrypi.org/** ▪ **https://www.arduino.cc/**	

	4.7 Activity: **Create your cloud service account and demonstrate using cloud services.** **Identify cloud service provider with respect to service models and deployment types.** **Identify areas where Internet of Things could bring positive changes.**	
5	**UNIT 5 - CYBERSECURITY AND SAFETY**	
	5.1 Introduction to Cyber security and cyber safety. ▪ Brief awareness on cyber safety measures ▪ Identification of basic security issues in mobile phones and personal computers ▪ Installation of Antivirus software ▪ Firewall concepts ▪ Browser settings ▪ Importance of privacy and Password policy (Best practices). 5.2 Common threats - Demonstration ▪ Phishing ▪ DoS attack ▪ Man in the middle attack ▪ Eavesdropping ▪ Spamming **5.3 Activity** ▪ **Identification of basic security issues in computers of your college and fixing the same.** ▪ **Visit nearby government organization.** ▪ **Identify basic cybersecurity issues and fixing the same** ▪ **Demonstrate the importance of cybersecurity, password policy, and cyber safety.**	1. Identify need for Cyber security and cyber safety 2. Identify basic security issues in mobile phones and personalcomputers 3. Examine Importance of privacy, Password policy 4. Implement best practices of cyber safety and security in work place

4. SUGGESTED PRACTICAL SKILL EXERCISES

TABLE-I

Sl. No.	Practical Out Comes/Practical exercises	Unit No.	PO	CO
1	Write an algorithm for programmable problems Example for Reference: • Add/subtract two numbers • Find the largest/smallest of 3 numbers • Calculate and print sum of 'N' numbers	1		
2	Design a flowchart for programmable problems Example for Reference: Add/subtract two numbers Find the largest/smallest of 3 numbers Calculate and print sum of 'N' numbers	1		
3	Design and create simple game using MIT-scratch/Code.org	1		
4	Design and create simple android application (MIT App Inventor)	1		
5	Design and create webpage for displaying your poem (Title, header, paragraph, formatting tags)	2		
6	Design and create webpage for your wish list (What you want to do). Also list challenges and opportunities along with images to present your dreams (List ordered and unordered, Image, table)	2		
7	Design and create webpage using HTML and CSS about an awesome animal (Use necessary CSS tags)	2		
8	Design and create web page for a travel book/recipe book with more than 3 pages, table to list places/recipes (iframe, hyperlink)	2		
9	Design and create web page with JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient	2		
10	Design and create a personal webpage with dashboard	2		
11	Design and create web page about advantages of business process automation with respect to your branch of engineering	2,3		

12	Create a workflow for education loan approval in bank/diploma admission process (Use any tool)	3		
13	Demonstrate ERP with ERPNext Demo for manufacturing, retail and service sector (Use any other ERP tools)	3		
14	Create user account and demonstrate use of Google drive, Google docs, Google Co-lab (Usage of Jupyter Notebook)	4		
15	5.1 Demonstrate Internet of Things using with examples a. Smart home b. Smart city c. Smart farming Note: Teacher can also select specific area of work where Things (autonomous computing devices) could be interconnected over TCP/IP to establish IoT.	4		
16	Installation of Antivirus software	5		
17	Demonstration and hands on browser settings	5		
18	Demonstration and hands on privacy settings and password policy	5		
19	Demonstration of common security threats (using videos) 6. Phishing 7. DoS attack 8. Man in the middle attack 9. Spamming 10. Virus	5		

The suggested practical activities (TABLE-I) in this section are demonstrated for the attainment of the competency. These practical activities can also be used for the student assessment in portfolio mode for awarding CIE marks. **The lecturer can enhance the competency level of the students by sketching more practical exercises.**

NOTES:

1. It is compulsory to prepare log book/record of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by the teacher
2. Student activities are compulsory and are also required to be performed and noted in logbook.
3. Student activity is compulsory and part of skill assessment. The activity enable student to explore the course, help student to demonstrate creativity & critical thinking.
4. Student activity report is compulsory part to be submitted at the time of practical ESE
5. Term work report is compulsory part to be submitted at the time of practical ESE.

6. Student activity and student activity reports must be uploaded to Learning management system.
7. For CIE, students are to be assessed for Skills/competencies achieved.

Communication Skills

Subject Code: - BSC104P **(0-0-3)**

Course Outcomes:

Students will be able to achieve & demonstrate the following:

1. Construct grammatically correct sentences in English.
2. Compose paragraphs and dialogues on given situations.
3. Comprehend passages correctly.
4. Use contextual words in English appropriately.
5. Deliver effective presentations in English using appropriate body language.

Unit 1: Vocabulary

Phonetics: Vowels (12), Consonants (24), Diphthongs (8). Prefix & Suffix: Definition & Examples, List of common prefixes and suffixes. Synonyms & Antonyms: Vocabulary expansion, Context & Usage. Homophones: Identifying Homophones, Meaning & Context, Vocabulary Expansion. Collocations: Definition & identification, Types of collocations.

Unit 2: Paragraph and Dialogue Writing

Types of paragraphs: Technical, Descriptive, Narrative. Dialogue Writing: i Greetings ii. Development iii. Closing Sentence Phonetic

Unit 3: Comprehension (Seen and Unseen Passages)

Say No to Plastic bags, Interview of Dr. APJ Abdul Kalam, Maximum Achievements, Be Remarkable, Arunima Sinha: A Biography, Roses of Gratitude. Importance of Comprehension. Unseen Passages. Interpretation of passages in written and spoken form.

- Let not confined to specific text.
- Literature available on related topic on electronic media or print media.
- Q/A on this topic.
- Unseen Passage for comprehension.

Unit 4: Communicative Language

Technical objects: i. Heading ii. Description of technical objects. Picture Description: i. Situational picture ii. Describe in your own words. Diary Entry: i. Date ii. Content iii. Name of the writer. Translation of paragraph from English to Marathi/Hindi-Vice versa (Question not to be asked on Translation in Theory Examination).

Unit 5: Presentation Skills

Dressing & Grooming: i. Dressing for the occasion ii. Proper grooming. Speech Writing: i. Situation ii. Salutations iii. Introduction of the topic iv. Description/Body v. Conclusion. Power Point Presentation: i. Layout ii. Font size iii. Color combination. Kinesics: i. Facial expressions ii. Eye contact iii. Postures iv. Gestures.

Exercise

Any 12 out of 16 exercises are compulsory;

1. Write 20 words using phonetic transcription.
2. Practice pronunciation as per IPA using language lab.
3. Formulate 20 words using Prefix and Suffix.
4. Construct sentences using 20 collocations.
5. Write two paragraphs of 75 words each.
6. Compose situational dialogues (Any Two).
7. Enact Role Plays as per situation and context.
8. Describe any three technical objects using correct grammar.
9. Narrate anecdotes of various situations in English.
10. Describe a given picture (Any Two).
11. Introduce oneself and others.
12. Prepare a Power point presentation on a given topic.
13. Translate paragraph --English to Hindi (vice -Versa) (Any4).
14. Write your experience in 50 words on (Four) given situations (Diary Entry).
15. Respond to the questions based on the given passages.
16. Deliver oral presentations using correct grammar and appropriate body language.

Suggested Learning Materials / Books

1. Kumar, E. Suresh, Sreehari, P Savitri, Effective English with CD, Pearson Education.
2. Gnanamurli, English Grammar at a Glance, S. Chand.
3. CBSE, English Communicative (class X), Golden.
4. Dr. Anjana Tiwari, Communication Skills in English, Khanna Publishers, New Delhi.

AUTOMOTIVE ENGINE

Subject Code: -MEC102P (0-0-3)

1. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences.

Perform Service & Repair Work of an IC engine in the Automobile Engineering Workshops/Service stations

2. INSTRUCTIONAL STRATEGY

1. The training methods to be used should be appropriate to the development of competencies. It should be individual centered to make each person a competent one.
2. Demonstrations using different models, audio visual aids and equipment be used intensively.
3. Instructor should expose to different tools used in Automobile service stations, Operational safety and Procedure to be followed for service & repair of different IC engines. Emphasis should be given on technical aspects as per manufacturer's standards& use of service manuals.
4. Focus should be on proper selection& use of measuring tools, service tools& equipment's and their proper use.

3. COURSE CONTENT

The following topics/sub topics are to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets.

SHOP	Topics/Sub topics	Unit skill set (In cognitive domain)
UNIT-1: **GENERAL STRUCTURE OF AUTOMOBILE**	1. Identify major systems of Automobile with their functions. 2. Identify major components of a 2-3 & 4-wheeler with their functions. 3. Measure the wheel base - wheel track - overall length - front overhung - rear overhung - height of CG point - ground clearance - gross weight and kerb weight of different vehicles. 4. Know the different manufacturing concerns of two-wheeler, three-wheeler, LMV and HTV – their products and plants location	Automobile - Classification of Automobile, Major systems of an Automobile - their functions, Chassis –chassis layout of two, three & four- wheeler with major components - their functions, engine mounts, definition of: wheel base - wheel track - overall length - front overhung - rear overhung - height of CG point - ground clearance - gross weight and kerb weight. Automobile manufacturing concerns oftwo & three-wheeler, LMV and HTV – their products and plants location

UNIT-2: CYLINDERBLOCK	1. Remove the cylinder head, gasket & crankcase using suitable tools. 2. Compare the cylinder block, cylinder head & gaskets of different materials with their advantages and disadvantages. 3. Explain & compare wet & dry liners with their merits & demerits. 4. Measure the ovality and taperness of cylinder bore using bore gauge. 5. Perform reboring & honing operations.	Cylinder block – types - Constructional details - materials used, Cylinder head - constructional details - materials used –Gasket- purpose- types, crank case, oil pan, cylinder liners – types – construction –comparison- merits and demerits.
UNIT-3: **PISTON & PISTON RINGS**	1. Remove piston-connecting rod assembly and piston rings using special tools. 2. Identify the different methods adopted to control piston expansion. 3. Describe the necessity of compression & oil ring with their constructional features 4. Perform measurement of piston ring gap, piston ring to groove clearance, piston OD, cylinder to piston clearance & compare them with standard values in service manual.	Piston - functions - requirements - constructional details - materials, pistonclearance – importance – piston slap- expansion controlling methods inpiston- heat dam- slots in piston- cam grounded, Piston rings – functions - types - constructional details – materials, Piston pin -construction – materials
UNIT-4 : **CONNECTINGROD, CRANKSHAFT& CAMSHAFT**	1. Remove crankshaft, camshaft & flywheel from the engine. 2. Know different methods of connecting piston with connecting rod and compare them. 3. Explain & compare the different camshaft drive mechanisms. 4. Checking of connecting rod, crankshaft, camshaft & flywheel as per service manual. 5. Measurement of crank pin diameter using vernier caliper & compare them with standard data.	Connecting rod and crank shaft– Constructional details, material - functions, List different methods of connecting piston with connecting rod – Explain fully floating type. Camshaft-functions– construction- materials, explain different types of camshaft drives. Flywheel-need-construction and materials.

UNIT - 5: VALVES & VALVE MECHANISM	1. Explain & compare the different types of valve mechanisms. 2. Dismantle the valve assembly and check them as per service manual. 3. Perform Re-conditioning of valve mechanism, measuring valve face angle, valve re-facing & honing. 4. Interpret the Valve timing diagram for four stroke petrol & diesel engines. 5. Set and adjust the valve clearance & know the importance of hydraulic valve lifter.	Poppet valve, valve materials, valvecooling - sodium cooled valve-overhead & side valve operating mechanism, overhead camshaft valve mechanism- valve seat- valve guide-valve spring, valve tappet, push rod,rocker arm & rocker shaft - hydraulicvalve lifter, variable valve timing Valve timing diagram for four strokepetrol engines & diesel engines- valve clearance- its importance.
UNIT-6: MANIFOLDS &MUFFLERS	1. Explain the need of firing order, firing order in multi cylinder engines 2. Remove inlet & exhaust manifold, differentiate them & identify the materials used. 3. Identify different types of mufflers with their working principle. 4. Service the inlet & exhaust manifold of different types 5. Assemble all the engine parts using appropriate tools and equipment's. Tighten the bolts to the specified torques as per service manual.	Multi cylinder engine- arrangement of multi cylinder engine cylinders- Meaning and need of firing order, firing order of three, four six- & eight- cylinder engines. Inlet and exhaust manifold, mufflers- purpose - constructional details of absorber type, baffle plate type, wave cancellation type and resonance typemufflers.

SL. No	Exercise	Unit No	PO	CO
1	Practice Health & Safety-%S technique (Sort, set in order, **S**hine/Sweep, **S**tandardize &**S**ustain). Identifying and practice on use of conventional tools, special tools & equipment's, pneumatic tools, used for dismantling and assembling the engine.	1		
2	Practice on use of measuring instruments such as vernier caliper, screw gauge, dial gauge, bore gauge, combination set square.	1		
3	Identify the major systems & components of a 2-3 & 4-wheeler and do their comparative study	1		
4	Measure the wheel base - wheel track - overall length - front overhung - rear overhung - height of CG point - ground clearance - gross weight and kerb weight of different vehicles and compare them with their manuals	1		
5	Conduct compression test & vacuum test on SI & CI engine and check with the standard values	2		
6	Remove any single cylinder engine from vehicle, drain engine oil and coolant, Water wash engine / degrease. Dismantle the engine parts, clean, inspect the parts. Check engine bore, cylinder, cylinder head, fins for warpage, cracks & rust.	2		
7	Measure the ovality and taperness of cylinder bore & compare with standard values.	3		
8	Practice on Re-boring of cylinder of single cylinder engine	3		
9	Practice on Honing of cylinder of single cylinder engine	3		
10	Practice on cleaning of piston & piston rings	3		
11	Measure the piston ring end gap, piston ring to groove clearance, piston OD, cylinder to piston clearance, compare the measurements with service manual	3		
12	Clean & check connecting rod, crankshaft, camshaft & flywheel	4		
13	Study the camshaft drive mechanism – remove, clean, check & overhaul its components	4		
14	Measure the crank pin/Journal diameters & compare them with service manual data	4		
15	Remove, clean, check & overhaul the valve mechanism Remove valve seats and valve guides-	5		
16	Check for valve stem bend, Check the condition of valve spring, Measure the valve face angle and compare with service manual data.	5		
17	Practice on Valve refacing /lapping by using valve refacing machine.	5		

18	Draw the Valve timing diagram for four stroke petrol engines & diesel engines.	5			
19	Assemble the engine by using appropriate tools with specified torques.	2,3, 4,5			
20	Set the valve tappet clearance for inlet and exhaust valves as specified in the manual	5			
21	Service the inlet & exhaust manifold of different types	6			
22	Observe and compare the arrangement of cylinders in a multi cylinder engine	6			
Total Hours					

SUGGESTED LEARNING RESOURCES :-

1 A course in Internal Combustion Engines M. L. Mathur, R. P. Sharma Dhanpat Rai and sons.
2 Automobile Engineering G. B. S. Narang. Khanna Publication
3 Automobile Engineering R. B. Gupta. S. Chand
4 Automobile Engineering (Vol II) Dr. Kripal Singh. Standard Publication
5 Automotive Engineering G. B. S. Narang. Tata McGraw Hill
6 Automobile Mechanics S. Shrinivasan Tata McGraw Hill
7 The Automobile Harbans Singth Royat. S. Chand Publication
8 Internal Combustion Engine V. Ganeshan Tata McGraw Hill
9 Automobile Engineering Ramlingam K. K. Saitech Publication
10 Automotive engines James D. Halderman Pearson

Websites:

1. How stuff works.com
2. http://en.wikipedia.org/wiki/Car
3. http://en.wikipedia.org/wiki/History_of_the_automobile
4. http://www.history.com/topics/automobiles.
5. http://en.wikipedia.org/wiki/History_of_the_automobile.
6. https://www.youtube.com/watch?v=fTAUq6G9apg.
7. https://www.youtube.com/watch?v=rWmR9UIz5iA.
8. https://www.youtube.com/watch?v=nAKTVBRNsmI.
9. https://www.youtube.com/watch?v=hV3LImCslpo.
10. https://www.youtube.com/watch?v=PYje-4D76kc.

*******THE END*******