Curriculum of Diploma Programme

in

Mechanical Engineering

**Department of Science,
Technology and Technical Education (DSTTE),
Govt. of Bihar**

**State Board of Technical Education
(SBTE), Bihar**

Semester – I
Teaching & Learning Scheme

Course Codes	Category of course	Course Titles	Teaching & Learning Scheme (Hours/Week)					
			Classroom Instruction(CI)		Lab Instruction (LI)	Notional Hours (TW+SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
			L	T				
2400101	ASC	**Basic Engg. Mathematics** (ME, ME (Auto), CE, MIE, CSE, AIML, EE, CRE, CHE, ELX, ELX (R))	02	01	-	02	05	04
2400102A	ASC	**Applied Chemistry -A** (CE, ME, ME (Auto), MIE, AE, FTS, CRE, CHE)	03	-	04	02	09	06
2418103	BCC	**Python Programming** (CE, CSE, AIML, EE, ME, ME (Auto)., ELX, ELX (R), MIE, FTS, CRE, CHE, TE, CACDDM, GT)	03	-	04	02	09	06
2400104	HSC	**Communication Skills (English)** (Common for all Programmes)	03	-	04	02	09	06
2425105	BEC	**Engineering Drawing** (ME, ME (Auto))	03	-	04	02	09	06
2400006	NRC	**Environmental Education and Sustainable Development** (Common for All Programmes)	01	-	01	01	03	02
Total			**15**	**1**	**17**	**11**	**44**	**30**

Note: Prefix will be added to course code if applicable (T for Theory Paper, P for Practical Paper and S for Term Work)

Legend:

CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. todeliver theoretical concepts)

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, work shop, field or other locations using different instructional/Implementation strategies)

Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.

TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.)

SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.

C: Credits= (1x CI hours) + (0.5 x LI hours) + (0.5 x Notional hours)

Note: TW and SL have to be planned by the teacher and performed by the learner under the continuous guidance and feedback of teacher to ensure outcome of learning.

Semester - I
Assessment Scheme

Course Codes	Category of course	Course Titles	Theory Assessment (TA)		Term work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		Total Marks (TA+TWA+LA)
			Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400101	ASC	Basic Engg. Mathematics (ME, ME (Auto), CE, MIE, CSE, AIML, EE, CRE, CHE, ELX, ELX (R))	30	70	20	30	-	-	150
2400102A	ASC	Applied Chemistry -A (CE, ME, ME (Auto), MIE, AE, FTS, CRE, CHE)	30	70	20	30	20	30	200
2418103	BCC	Python Programming (CE, CSE, AIML, EE, ME, ME (Auto)., ELX, ELX (R), MIE, FTS, CRE, CHE, TE, CACDDM, GT)	30	70	20	30	20	30	200
2400104	HSC	Communication Skills (English) (Common for all Programmes)	30	70	20	30	20	30	200
2425105	BEC	Engineering Drawing (ME, ME (Auto))	30	70	20	30	20	30	200
2400006	ASC	Environmental Education and Sustainable Development (Common for All Programmes)	15	-	10	-	10	15	50
		Total	**165**	**350**	**110**	**150**	**90**	**135**	**1000**

Note: Prefix will be added to course code if applicable (T for Theory Paper, P for Practical Paper and S for Term Work)

Legend:
PTA: Progressive Theory Assessment in class room (includes class test, mid-term test and quiz using online/offline modes)
PLA: Progressive Laboratory Assessment (includes process and product assessment using rating Scales and rubrics)
TWA: Term work & Self Learning Assessment (Includes assessment related to student performance in assignments, seminars, micro projects, industrial visits, self-learning, any other student activities etc.
Note:

- ETA & ELA are to be carried out at the end of the term/ semester.

- Term Work is to be done by the students under the guidance of internal faculty but its assessment will be done **internally (40%)** as well as **externally (60%)**. Assessment related to planning and execution of Term Work activities like assignment, micro project, seminar and self-learning is to be done by internal faculty (Internal Assessment) whereas assessment of output/product/ presentation related to these activities will becarried out by external faculty/expert (External Assessment). However, criteria of internal as well as external assessment may vary as per the requirement of respective course. For valid and reliable assessment, the internal faculty should prepare checklist & rubrics for these activities

J)   Theory Session Outcomes (TSOs) and Units: T2400101

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Find the solution of a system of equations in three unknowns by applying Cramer's rule. *TSO 1b.* Solve simple given problems based on the Algebra of matrices. *TSO 1c.* Find the inverse of the matrix by applying the concept of Adjoint of the matrix. *TSO 1d.* Find a solution of simultaneous equations in three variables using the concept of the Matrix Inversion method. *TSO 1e.* Solve problems based on the sum, and subtraction of Vectors. *TSO 1f.* Solve simple problems related to Scalar and Vector product of vectors. *TSO 1g.* Solve simultaneous equations by using concepts given in Ancient Indian Mathematics. (IKS)	**Unit-1.0 Algebra Determinant** 1.1 Concept and properties of determinant. 1.2 Solutions of simultaneous equations in three Unknowns by Cramer's rule. **Matrices** 1.3 Algebra of matrices (Addition, Subtraction, Multiplication by Scalar, and Multiplication of Two matrices). 1.4 Transpose, Adjoint and Inverse of Matrix. 1.5 Solutions of simultaneous equations of a Matrix of order 3 x3 by Inversion method. **Vectors** 1.6 Position vector. 1.7 Algebra of Vectors (Addition, Subtraction, Scalar Multiplication with vector). 1.8 Scalar product. 1.9 Vector product. 1.10 Algebra in Indian Knowledge System: Solution of simultaneous equations (Indian Mathematics). (IKS)	CO1
TSO 2a. Define the concept of a function and its types. *TSO 2b.* Solve simple problems based on Domain and range of function. *TSO 2c.* Evaluate problems of limit function based on Indeterminate form. *TSO 2d.* Check the continuity of a function at a point. *TSO 2e.* Find the differentiation of some simple functions (sinx, cosx, tanks, and e^x) by the first principle. *TSO 2f.* Calculate the derivative of given Algebraic, trigonometric, and exponential functions. *TSO 2g.* Find the derivative of the given two functions' sum, product, and quotient. *TSO 2h.* Find the differentiation of given composite functions by applying the concept of the Chain rule. *TSO 2i.* Find the derivative of Logarithmic, Implicit, and Parametric functions. *TSO 2j.* Familiar with the concept of calculus given in Indian Mathematics. (IKS)	**Unit-2.0 Differential Calculus** **Function and Limit** 2.1 Concept of function. 2.2 Different type of functions. 2.3 Domain and Range of Function. 2.4 Concept of Limits and its evaluation. **Continuity** 2.5 Concept of continuity with simple problems. **Differentiation** 2.6 Differentiation by First Principle. 2.7 Differentiation of Algebraic, trigonometric, Exponential, and Logarithmic functions. 2.8 Differentiation of sum, product, and quotient of two functions. 2.9 Differentiation of composite functions by Chain Rule. 2.10 Logarithmic differentiation. 2.11 Implicit differentiation. 2.12 Differentiation of Parametric Functions. 2.13 Calculus in Indian Knowledge System: The Discovery of Calculus by Indian Astronomers. (Indian Mathematics). (IKS)	CO2
TSO 3a. Find the second-order derivative of given simple functions.	**Unit-3.0 Application of Differential Calculus** 3.1 Successive differentiation up to second order.	CO3

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 3b. Solve simple problems based on Rolle's Theorem and Mean Value Theorem. *TSO 3c.* Apply the concept of Rate of change to solve simple problems related to velocity, and acceleration. *TSO 3d.* Apply rules of derivative to solve given applied problems related to tangent and normal. *TSO 3e.* Apply rules of derivative to solve applied problems based on Maxima-Minima and Radius of curvature.	3.2 Rolle's Theorem and Mean Value Theorem (without proof) with examples. 3.3 Rate of change of quantities. 3.4 Equation of Tangent and Normal. 3.5 Maxima and Minima. 3.6 Radius of curvature.	
TSO 4a. Calculate the angle between the given two lines and also find the slope. *TSO 4b.* Formulate an equation of straight lines of different forms. *TSO 4c.* Find the perpendicular distance of a straight line from a given point and the perpendicular distance between two parallel lines. *TSO 4d.* Use the geometry given in Sulabasutras to solve the given problems. *TSO 4e.* Solve simple problems related to Circles and Parabola for engineering applications. *TSO 4f.* Solve given simple problems related to Ellipse for engineering applications.	**Unit-4.0 Co-ordinate Geometry** **Co-ordinate systems** 4.1 Introduction of Co-ordinate Systems. **Straight lines** 4.2 Slope of a line, the angle between two lines. **Various forms of Straight Lines** 4.3 Point-slope form, Two-point form, Slope intercept form, Intercept form, Normal form, General form. 4.4 Perpendicular distance of a line from a point, perpendicular distance between two parallel lines. 4.5 Geometry in Sulabasutras in Indian Knowledge System (construction of the square, circling the square). (Indian Mathematics). **Conic Section** 4.6 Introduction of Conic-Section. 4.7 Equation of Circle in standard form. 4.8 Standard equation of parabola, ellipse, and hyperbola.	CO4
TSO 5a. Compute the probability of given simple problems based on the Addition and Multiplication theorem. *TSO 5b.* Evaluate the Mean, Median, and Mode of the given data for engineering applications. *TSO 5c.* Calculate the Range, Variance, and standard deviation of given data for engineering applications. *TSO 5d.* Calculate the Coefficient of variance of given data for engineering applications.	**Unit-5.0 Probability and Statistics** **Probability** 5.1 Concept of Probability. 5.2 Addition and multiplication theorems of Probability. **The measure of Central Tendency** 5.3 Mean, Median, Mode. **Measure of Dispersion** 5.4 Range, Variance, Standard Deviation. 5.5 Coefficient of Variation.	CO5

Note: One major TSO may require more than one Theory session/Period.

K) Suggested Tutorials and Outcomes:

Outcomes	S. No.	Tutorials Titles	Relevant COs Number(s)
1.1 Determine the value of the determinant by using available open-source software. 1.2 Determine the inverse of a non-singular matrix by using open-source software. 1.3 Apply the Matrix Inversion method to determine currents through various branches of given electrical networks. 1.4 Determine the resultant force applied at a particle using properties of vector for a given engineering problem.	1.	• Value of determinant of order 3, 4, and higher using opensource software. • Inverse of the non-singular matrix using open-source software. • Calculation of current in electrical networks by Matrix Inversion method. • Geometrical interpretation of operations of vector algebra.	CO1
2.1 Geometrically represent the domain and range of the given Modulus function, Signum function, and Floor function. 2.2 Verify geometrically the continuity of a given function at a point. 2.3 Determine the concavity and convexity of a given continuous function for a given engineering application. 2.4 Find the acceleration of the given moving body at a time t.	2.	• Geometrical interpretation of domain and range of a function. • Geometrical interpretation of limit and continuity. • Branch-specific engineering application of derivative. • Branch-specific engineering application of derivative of a parametric function.	CO2
3.1 Determine the maximum height of a projectile trajectory using Roll's theorem. 3.2 Use Lagrange's Mean Value theorem to find the point at which the slope of the tangent becomes equal to the slope of the secant through its endpoints. 3.3 Use the concept of derivative to find the slope of a bending curve for a given engineering problem. 3.4 Use the concept of tangent and normal to solve the given problem of Engineering Drawing. 3.5 Use the concepts of Maxima and Minima to obtain optimum value for a given engineering problem. 3.6 Use the concept of the radius of curvature to solve a given branch-specific engineering problem.	3.	• Geometrical Interpretation of Rolle's Theorem. • Geometrical Interpretation of Lagrange's Mean Value theorem. • Branch-specific engineering application of rate of change of quantities. • Branch-specific engineering applications of tangent and normal. • Branch-specific engineering applications of maxima and minima. • Engineering applications of Radius of curvature.	CO3
4.1 Apply the concept of Gradient to draw graphs in engineering drawing. 4.2 Use the given form of a straight line to calculate the speed, distance, and time of a moving object. 4.3 Use the concept of Ellipse to prepare a Model of the path of the Planet and its foci.	4.	• Geometrical interpretation of Gradient. • Geometrical Interpretation of lines in various forms. • Geometrical interpretation of the perpendicular distance of a line. • Geometrical representation of conic-section.	CO4

Outcomes	S. No.	Tutorials Titles	Relevant COs Number(s)
5.1 Use the concept of probability to solve given problems based on Board and playing cards. 5.2 Calculate the Standard Deviation for Concrete with the given data.	5.	• Applications of Probability and related theorems. • Applications of Mean, Median, and Mode for applied problems.	CO5

L)   **Suggested Term Work and Self-Learning: S2400101** Some sample suggested assignments, micro-projects, and other activities are mentioned here for reference.

a.   Assignments: Questions/Problems/Numerical/Exercises to be provided by the course teacher in line with the targeted COs.

1. Solve the simultaneous system of equations in two variables by Matrix Inversion Method. Write down a Mathematical program using any open-source software to verify the result.
2. A rigid body is subjected to multiple forces acting at different points. Apply vector technique to calculate the net moment or torque acting on the body. Discuss the equilibrium condition and the significance of the moment in terms of structural integrity and mechanical system using open-source software.
3. Represent the Graph of the Trigonometric function and logarithmic function on GeoGebra. Interpret the nature of the graph and make a pdf file.
4. Find the derivative of $y = x^{sinx}$ and visualize the graph of the function and its derivative using any open-source software geometrically.
5. A window in the form of a rectangle surmounted by a semi-circular opening. The total perimeter of the window to admit maximum light through the whole opening. Prepare a model using the concept of Maxima and Minima for the above problem and verify the result.
6. Find the curvature of $x = 4cost$ and $y = 3sint$, at what point on this ellipse does the curvature have the greatest and least values? What are the magnitudes? Visualize the result graphically using any open-source software.
7. When a double-sided right circular cone is intersected by a plane, different types of conic sections are generated. Represent all these conic sections on GeoGebra and write down their equation.
8. Explain how parabolic reflectors are used in engineering applications such as Satellite Dish Antennas or headlights.
9. By Collecting the Data of the Last 5 IPL series, Calculate the probability of winning a match by any two teams.
10. Collect the Data of Marks obtained by your class in 1st class test. Compute the Mean, Median, Mode, and variance of the data and interpret the result.

b.   Micro Projects:

1. Prepare charts displaying the properties of determinants and Matrices.
2. Prepare a chart for the use of Vector algebra to solve problems of the rate of change of the mass of a fluid flow.
3. Draw the graph of functions like x^2, $sinx$, $cosx$, $tanx$, and e^x etc analytically on graph paper and verify using suitable open-source software like Sage Math, Math3d, GeoGebra, Wolfram Alpha, and Dplot and prepare a pdf file.
4. Collect at least 10 engineering applications for each Limits, Continuity, and Differentiability and prepare a PDF file.

J)   Theory Session Outcomes (TSOs) and Units: T2400103A

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO-1a Describe the three subatomic particles in an atom. TSO-1b Conclude Rutherford model of atom. TSO-1c Apply the different atomic theories and principles for structural illustration. TSO-1d Calculate uncertainty in position and momentum. TSO-1e Draw the shapes of s, p and d orbitals. TSO-1f Write the electronic configuration of different elements. TSO-1g Differentiate between ionic, covalent, and coordinate compounds based on the type of chemical bonding. TSO-1h Explain the unique behavior of water. TSO-1i Prepare the solution of given concentration.	**Unit-1.0 Atomic Structure and Chemical Bonding and Solutions:** 1.1 Atoms and its fundamental particles. 1.2 Rutherford Model of Atom. 1.3 Bohr's Theory, Hydrogen spectrum explanation based on Bohr's Model of Atom. 1.4 Wave Mechanical model of atom, de Broglie relationship, Heisenberg Uncertainty Principle 1.5 Quantum Numbers, Shapes of Atomic Orbitals. 1.6 Pauli's Exclusion Principle, Hund's Rule of Maximum Multiplicity, Aufbau Principle, Electronic Configuration (till atomic number 30). 1.7 Concept of Chemical bonding - Cause of chemical bonding, Types of Bonds: Ionic Bond ($NaCl$, $CaCl_2$, MgO), Covalent Bond, Polar and Nonpolar Covalent Bonds (H_2. F_2. HF, HCl) & Co-ordinate Bond (CO, NH_4^+, O_3, H_2SO_4),. 1.8 Dipole Moment (NH_3, NF_3), Hydrogen bonding. 1.9 Solution- (solute, solvent) and their strength- Molarity, Normality, Molality. 1.10 Indian Chemistry: -Philosophy of atom by Acharya Kanad. (IKS)	CO1
TSO-2a Classify hard and soft water based on their properties. TSO-2b List the impurities responsible for hardness. TSO-2c Calculate the hardness of water. TSO-2d Determine the hardness by EDTA method. TSO-2e Apply different water softening techniques to soften the hard water. TSO-2f Calculate the amount of lime and soda required for removal of hardness. TSO-2g Differentiate between BOD and COD. TSO-2h Use the Indian standard specification of drinking water.	**Unit-2.0 Water** 2.1 Introduction, Sources of Water. Hardness of Water- Temporary & Permanent hardness. 2.2 Degree of Hardness (In terms of $CaCO_3$ equivalent), Unit of Hardness, Quantitative Measurement of Water Hardness by EDTA method. 2.3 Municipal supply of Water, Treatment of water, Water Softening Technique-Soda Lime Process, Zeolites method and ion exchange method. 2.4 Water Quality Index - Biological Oxygen Demand, Chemical Oxygen Demand, Determination of Dissolved Oxygen 2.5 Indian standard specification of drinking water.	CO2
TSO-3a List ores of metals. TSO-3b Describe ore, gangue, matrix. TSO-3c Select Appropriate metallurgical processes for concentration, extraction, and purification of given ore. TSO-3d Describe alloy with examples. TSO-3e Write the constituent of given alloy. TSO-3f Write the composition properties and uses of ferrous and non-ferrous alloys. TSO-3g Distinguish between homopolymer and copolymer. TSO-3h Write the monomers of given polymers. TSO-3i Explain vulcanization process.	**Unit-3.0 Engineering materials** 3.1 Natural Occurrence of Metals- Minerals, ores. 3.2 Metallurgy - General principles of Metallurgy, Gangue, Flux and Slag, Steps involved in metallurgy. 3.3 Extraction of Aluminium, Iron and Copper from their important ores along with reactions, Properties and uses. 3.4 Alloys – Definition, Purpose of alloying, Ferrous and Non-Ferrous Alloy with suitable examples, Composition, Properties, and their applications. 3.5 Ancient Indian Metallurgy (IKS) 3.6 Polymers-Homopolymers and Copolymers,	CO3

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO-3j Explain cement & its manufacture. TSO-3k Differentiate among the different engineering materials based on their chemical composition and composition-based applications.	Natural polymers and synthetic polymers, Addition and Condensation polymerization, Thermoplastic and Thermosetting plastic. 3.7 Monomers, applications, and synthesis of Polythene, PVC, Orlon, Terylene, Nylon 66, Nylon 6, Bakelite. 3.8 Natural Rubber and its vulcanization, advantages of vulcanized rubber. 3.9 Cement, Average composition of Portland cement, Raw material for manufacture of cement, Setting of Cement.	
TSO-4a Classify fuels. TSO-4b Describe HCV and LCV. TSO-4c Explain knocking, octane number and cetane number. TSO-4d Use different gaseous fuels based on their composition, calorific value, and other properties. TSO-4e Explain uses of NPK fertilizers. TSO-4f Select relevant lubricant based on their composition, calorific value, and other properties. TSO-4g Determine viscosity, flash, and fire point of given lubricant for its specific use. TSO-4h Explain Flash, Fire, Cloud & Pour point.	**Unit-4.0 Chemistry of Fuel and Lubricants** 4.1 Fuels, Characteristics of an Ideal Fuel. 4.2 Classification of Fuel- Solid, liquid and gas fuel, Calorific Values (HCV and LCV), 4.3 Petroleum and its fractional distillation. 4.4 Cracking, knocking, Fuel Rating (Octane Number, Cetane Number). 4.5 Composition, uses, advantages and disadvantages of LPG, CNG and Biogas. 4.6 Manures, NPK fertilizers (preparation and uses). 4.7 Fire Extinguishers and their types. 4.8 Lubricants- Classification of Lubricants with examples, Functions and Properties of Good Lubricant. 4.9 Viscosity & Viscosity Index. Flash point. Fire point, Cloud & Pour point	CO4
TSO-5a. Describe Electrolyte and Nonelectrolyte. TSO-5b. Describe Metallic and electrolytic conduction. TSO-5c. Explain the faraday law of electrolysis. TSO-5d. Calculate the mass of metal deposited after passing a certain amount of current. TSO-5e. Calculate the emf at different temperature, pressure, and molar concentration. TSO-5f. Predict the feasibility of a cell. TSO-5g. Explain the working of a cell. TSO-5h. Describe corrosion. TSO-5i. Explain the different methods to prevent corrosion.	**Unit-5.0 Electrochemistry** 5.1. Introduction, Electrolyte and Nonelectrolyte, Electrolytic and Metallic Conduction, Factors affecting Electrolytic Conductance. 5.2. Molar Conductivity and Equivalent Conductivity. Variation of Molar Conductivity, Kohlrausch's law. 5.3. Faraday's Laws of Electrolysis. 5.4. Galvanic Cell, Electrode Potential, Measurement of Electrode Potential SHE (Standard Hydrogen electrode), EMF, Electrochemical Series, Nernst Equation for Electrode Potential. 5.5. Batteries, Primary Cells-Dry cell, Secondary cell -Lead storage battery, Fuel cells. 5.6. Corrosion, their types (Dry & Wet corrosion) and prevention.	CO5

Note: One major TSO may require more than one Theory session/Period.

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2400103A

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO-1.1. Calculate amount of oxalic acid required. *LSO-1.2.* Prepare N/10 oxalic acid solution.	1.	Preparation of 250 ml of N/10 Oxalic acid Solution	**CO1**
LSO-2.1. Calculate amount of Sodium Carbonate required. *LSO-2.2.* Prepare N/10 Sodium Carbonate Solution.	2.	Preparation of 250ml of N/10 Sodium Carbonate Solution.	**CO1**
LSO 3.1. *Perform acid base titration.* *LSO 3.2.* Prepare oxalic acid solution	3.	Determination of strength of Sodium Hydroxide solution by titrating against Oxalic Acid Solution	**CO1**
LSO 4.1. Perform Complexometric titration. *LSO 4.2.* Standardize EDTA solution.	4.	Determination of the total hardness of tap water by EDTA method	**CO2**
LSO 5.1. Calculate % of moisture	5.	Estimation of moisture content in given coal sample gravimetrically.	**CO4**
LSO-6.1. Perform double displacement reaction. *LSO-6.2.* Test the presence of sulphate.	6.	Preparation of Barium Sulphate from Barium Chloride.	**CO2**
LSO-7.1. Use viscometer. *LSO-7.2.* Calculate viscosity using the drop number method.	7.	Determination of viscosity of liquid Using Ostwald Viscometer.	**CO4**
LSO-8.1. Construct Daniel cell. *LSO-8.2.* Compare the effect of dilution of electrolytes on the emf of a Daniel cell.	8.	Comparison of the effect of dilution of electrolytes on the emf of a Daniel cell.	**CO5**
LSO 9.1. Perform acid base titration using pH meter.	9.	Determination of pH of given solution by pH meter.	**CO2**
LSO-10.1. Carry out Polymerization. *LSO-10.2.* Set the environment for carrying out polymerization.	10.	Preparation of Phenol Formaldehyde Resin (Bakelite).	**CO3**
LSO-11.1. Perform iodometry titration. *LSO-11.2.* Use of starch as indicator.	11.	Determination of dissolved Oxygen in given sample of Water.	**CO2**
LSO-12.1. *Calculate pH.*	12.	Determination of pH of soil using baking soda and vinegar.	**CO2**

L) Suggested Term Work and Self Learning: S2400103A Some sample suggested assignments, micro project and other activities are mentioned here for reference.

a. Assignments: Questions/Problems/Numerical/Exercises to be provided by the course teacher in line with the targeted Cos such as

1. Write electronic structure of given atoms.
2. Compare the wavelengths of different macroscopic and microscopic particles moving with same velocity.
3. Prepare a model to find the soap lather forming capacity of tap water on addition of lime.
4. Prepare chart showing different industrial application of metal and relate it with required property or properties using internet.
5. Explain the working principle of TEL as antiknock.
6. Prepare chart showing different types of liquid fuels with their calorific values and uses.
7. Prepare a comparative chart of commercially available lubricants based on mechanism of lubrication.
8. Compare the EMF of Zinc - Copper cell with different cathodic concentration and predict out of low and high cathodic concentration, which increases EMF?
9. Prove the statement mathematically. "It is impossible to determine the position and momentum simultaneously with accuracy."

- Term Work is to be done by the students under the guidance of internal faculty but its assessment will be done **internally (40%)** as well as **externally (60%)**. Assessment related to planning and execution of Term Work activities like assignment, micro project, seminar and self-learning is to be done by internal faculty (Internal Assessment) whereas assessment of output/product/ presentation related to these activities will be carried out by external faculty/expert (External Assessment). However, criteria of internal as well as external assessment may vary as per the requirement of respective course. For valid and reliable assessment, the internal faculty should prepare checklist & rubrics for these activities.

I) **Course Curriculum Detailing:** This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Term Work (TW) and Self Learning (SL). Students are expected to demonstrate the attainment of Theory Session Outcomes (TSOs) and Lab Session Outcomes (LSOs) leading to attainment of Course Outcomes (COs) upon the completion of the course. While curriculum detailing, NEP 2020 related reforms like Green skills, Sustainability, Multidisciplinary aspects, Society connect, Indian Knowledge System (IKS) and others must be integrated appropriately.

J) **Theory Session Outcomes (TSOs) and Units: T2418103**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Differentiate between Procedure Oriented P and Object-Oriented Programming approach with example. *TSO 1b.* Use the concept of Lvalue and Rvalue. *TSO 1c.* Write python program using various data types and operators.	**Unit-1.0 Basics of Python Programming syntax** 1.1 Python character set, Python tokens, variables, concept of Lvalue and Rvalue, use of comments 1.2 Data types: number (integer, floating point, complex), Boolean, sequence (string, list, tuple), none, mapping (dictionary), mutable and immutable data types 1.3 Operators: arithmetic operators, relational operators, logical operators, assignment operator, augmented assignment operators. Expressions, statement, type conversion & input/output: precedence of operators, expression, evaluation of expression.	**CO-1**
TSO 2a. Write Python program using decision making statements. *TSO 2b.* Write Python program using loop structure to solve iterative problems.	**Unit-2.0 Conditional and Iterative statements** 2.1 Conditional statements: simple if statement, if- else statement, if-elif-else statement	**CO-2**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	2.2 Iterative statements: while loop, for loop, range function, break and continue statements, nested loops	
TSO 3a. Perform various operations on string using string operators and methods. *TSO 3b.* Perform various operations on List using list operators and methods. *TSO 3c.* Perform various operations on tuples using tuples operators and methods. *TSO 3d.* Perform various operations on set using set methods. *TSO 3e.* Perform various operations on dictionary using dictionary methods.	**Unit-3.0 String, List, Tuples, set and Dictionary** 3.1 String: indexing, string operations (concatenation, repetition, membership & slicing), traversing a string using loops, built-in functions 3.2 Lists: introduction, indexing, list operations: concatenation, repetition, membership & slicing, traversing a list, built- in list functions, linear search on list of numbers and counting the frequency of elements in a list 3.3 Tuples: Creating, initializing, accessing elements, tuple assignment, performing operations on tuples, tuple methods and built-in functions, nested tuples 3.4 Set: Creating set, traversing, adding, removing data in set, performing set operations like join, Union intersection, difference 3.5 Dictionary: accessing items in a dictionary using keys, mutability of dictionary: adding a new item, modifying an existing item, built-in dictionary functions.	**CO-3**
TSO 4a. Create and use user defined functions to implement modular programming approach. *TSO 4b.* Differentiate variable scope with example. *TSO 4c.* Import and use Python modules, libraries.	**Unit-4.0 Python Functions, Modules and packages** 4.1 Functions: types of function (built- in functions, functions defined in module, user defined functions), creating user defined function, arguments and parameters, default parameters, positional parameters, Lambda functions, returning value, scope of a variable: global scope, local scope 4.2 Modules and Packages: Importing module using 'import' Regular Expressions, Exception Handling, PyPI Python Package Index, Pip Python package manager, Importing Libraries and Functions	**CO-4**
TSO 5a. Write simple Python programs with object-oriented approach. *TSO 5b.* Use constructors and destructors appropriately in python program.	**Unit-5.0 Object Oriented Programming (OOP)** 5.1 OOPs Object oriented programming concepts and approach, Abstraction, encapsulation, class, object, class	**CO-5**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 5c. Explain different type of inheritance based on its characteristic. *TSO 5d.* Implement given type of inheritance in Python. *TSO 5e.* Implement the concept of Polymorphism in Python.	method vs static method in Python, class and static variable, constructor and destructors in python 5.2 Inheritance: types of inheritance: single, multiple, multilevel, hierarchical 5.3 Polymorphism: Polymorphism with class method, polymorphism with inheritance, method overriding, overloading	
TSO 6a. Explain different types of Exceptions in python. *TSO 6b.* Write Python programs for exception handling in Python. *TSO 6c.* Differentiate different modes of file opening. *TSO 6d.* Perform read, Write, Append operations in files.	**Unit 6.0: Exception and File Handling in Python** 6.1 Exception Handling: syntax errors, exceptions, need of exception handling, user-defined exceptions, raising exceptions, handling exceptions, catching exceptions, Try - except - else clause, Try - finally clause, recovering and continuing with finally, built-in exception classes. 6.2 File Handling: text file and binary file, file types, open and close files, reading and writing text files, reading and writing binary files, file access modes	**CO-6**

Note: One major TSO may require more than one Theory session/Period.

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical:

P2418103

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Write, execute and debug simple Python program using Integrated Development and Learning Environment (IDLE) *LSO 1.2.* Write and execute simple 'C' program using variables, arithmetic expressions.	1.	a) Download and Install IDLE. Write and execute Python program to- b) Calculate the Area of a Triangle where its three sides a, b, c are given. s=(a+b+c)/2, Area=square root of s(s-a)(s-b)(s-c) (write program without using function) c) Swap Two Variables d) Solve quadratic equation for real numbers.	CO-1
LSO 2.1. Write and execute python programs using conditional statements. *LSO 2.2.* Write and execute python programs using various types of Loop statements	2.	Write and execute Python program to- a) Check if a Number is Positive, Negative or zero. b) Check whether the given year is a Leap Year. c) Print all Prime Numbers in an Interval. d) Display the multiplication Table based on the given input.	CO-2

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
		e) Print the Fibonacci sequence. f) Find the Factorial of a Number.	
LSO 3.1. Write and execute Python program to perform various operations on string using string operators and methods	3.	Write and execute Python program to- a) Check whether the string is Palindrome b) Reverse words in a given String in Python c) identify in a string the name, position and counting of vowels. d) Count the Number of matching characters in a pair of string (set) e) Python program for removing i-th character from a string	CO-2, CO-3
LSO 4.1. Write and execute Python program to perform various operations on List using List operators and methods	4.	Write and execute Python program to- a) find largest number in a given list without using max (). b) find the common numbers from two lists. c) create a list of even numbers and another list of odd numbers from a given list. d) To find number of occurrences of given number without using built-in methods.	CO-2, CO-3
LSO 5.1. Write and execute Python program to perform various operations on Tuple using Tuple operators and methods.	5.	Write and execute Python program to- a) find the index of an item of a tuple. b) find the length of a tuple. c) to reverse a tuple. d) Write a Python program to sort a list of tuples by its float element. Sample data: [('item1', '12.20'), ('item2', '15.10'), ('item3', '24.5')] Expected Output: [('item3', '24.5'), ('item2', '15.10'), ('item1', '12.20')]	CO-2, CO-3
LSO 6.1. Write and execute Python program to perform various operations on sets using set methods.	6.	Write and execute Python program to- a) create an intersection of sets. b) create a union of sets. c) create set difference. d) check if two given sets have no elements in common.	CO-2, CO-3
LSO 7.1. Write and execute Python program to perform various operations on Dictionary using Dictionary methods	7.	Write and execute Python program to- a) Write a Python script to concatenate two dictionaries to create a new one b) Write a Python script to merge two Python dictionaries. c) Write a Python program to combine two dictionary adding values for common keys. d1 = {'a': 100, 'b': 200, 'c':300} d2 = {'a': 300, 'b': 200, 'd':400}	CO-2, CO-3

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
		Sample output: d({'a': 400, 'b': 400, 'd': 400, 'c': 300})	
LSO 8.1. Write and execute Python program to create user defined functions and call them.	8.	Write and execute Python program to- a) Write a Python function for reversing a string and call it. b) Write a Python function for calculating compound interest and call it. c) Write a Python function for calculating the factorial of a number and call it to calculate n! / (r!)*(n-r)!) where symbol "**!**" stands for factorial.	CO-2, CO-4

LSO 9.1.   Write and execute Object Oriented Python program to define a class and its instances.
 	
 LSO 9.2.   Develop and execute Python program Using various types of inheritances.
 	
 LSO 9.3.   Develop and execute Python program Using various types of inheritances.
 	
 LSO 9.4.   Develop and execute Python program Using various types of Polymorphism.
	9.	Write program using OOP approach to –
		 a) create an instance of a specified class and display the namespace of the said instance
		 b) create a Python class named Student with two attributes: student_id, student_name. Add a new attribute: student_class. Create a function to display all attributes and their values in the student class.
		 c) Create a Python class named Student with two instances student1, student2 and assign values to the instances' attributes. Print all the attributes of the student1, student2 instances
		 d) Write programs to demonstrate use of following types of inheritance:
		   i. Single inheritance
		   ii. Multiple inheritance
		   iii. Multilevel inheritance
		 e) Demonstrate use of polymorphism with following situations:
		   i. Polymorphism in operator
		   ii. Polymorphism in user defined method
		   iii. Polymorphism in built-in function
		   iv. Polymorphism with class method
		   v. Polymorphism with method overriding
			CO-2, CO-5

LSO 10.1. Develop and execute Python program to handle various type of exceptions.
 	
 LSO 10.2. Develop and execute Python program to perform file operations.
	10.	a) Using exception handling feature such as try…except, try finally- write minimum three programs to handle following types of exceptions.
		   i. Type Error
		   ii. Name Error
		   iii. Index Error
		   iv. Key Error
			CO-6, CO-1, CO-2,

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
		v. Value Error vi. IO Error vii. Zero Division Error b) Write Python program to demonstrate file operations.	

Note: in addition to above listed practical, students are suggested to practice all the examples covered by the teacher during theory sessions.

L)   **Suggested Term Work and Self Learning: S2418103** Some sample suggested assignments, micro project and other activities are mentioned here for reference.

a. **Assignments:** Questions/Problems/Numerical/Exercises to be provided by the course teacher in line with the targeted COs.

b. **Micro Projects:**

1. Crete a shop billing system
2. Create income tax calculation system.
3. Develop number guessing game (random integer will be selected by the system and the user has to guess that integer in the minimum number of guesses. Maximum 5 guess allowed.)
4. Assign numbers to alphabet a-z as (1-26). User will input a word. System will convert in to a number by adding all the individual alphabet of that word.
5. Design a basic calculator program that performs arithmetic operations like addition, subtraction, multiplication, and division based on user input.
6. Any other micro-projects suggested by subject faculty on similar line.

(Students may use file and sequence data types to develop above listed applications)

c. **Other Activities:**

1.   Seminar Topics:
- Tkinter widgets in python
- Python date/time module and its applications
- wxPython and its applications

M)   **Suggested Course Evaluation Matrix:** The course teacher has to decide and use appropriate assessment strategy and its weightage in theory, laboratory and Term Work for ensuring CO attainment. The response/performance of each student in each of these designed activities is to be used to calculate **CO attainment**.

	Course Evaluation Matrix					
	Theory Assessment (TA)**		Term Work Assessment (TWA)	Lab Assessment (LA)#		
COs	Progressive Theory	End Theory	Term Work & Self Learning Assessment	Progressive Lab Assessment	End Laboratory	

	Assessment (PTA) Class/Mid Sem Test	Assessment (ETA)	Assignments	Micro Projects	Other Activities*	(PLA)	Assessment (ELA)
CO-1	10%	10%	15%	16%	16%	10%	16%
CO-2	15%	15%	15%	16%	16%	15%	16%
CO-3	25%	25%	20%	18%	18%	25%	18%
CO-4	15%	15%	15%	16%	16%	15%	16%
CO-5	25%	25%	25%	18%	18%	25%	18%
CO-6	10%	10%	10%	16%	16%	10%	16%
Total Marks	30	70	20	20	10	20	30
				50			

Legend:

*: Other Activities include self- learning, seminar, visits, surveys, product development, software development etc.

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

• The percentage given is approximate

• In case of Micro Projects and End Laboratory Assessment (ELA), the achieved marks will be equally divided in all those COs mapped with total experiments.

• For CO attainment calculation indirect assessment tools like course exit survey need to be used which comprises of questions related to achievement of each COs.

N) Suggested Specification Table for End Semester Theory Assessment: Specification table represents the reflection of sample representation of assessment of cognitive domain of full course.

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Basics of Python Programming syntax	4	CO-1	7	3	2	2
Unit-2.0 Conditional and Iterative statements	6	CO-2	10	3	3	4
Unit-3.0 3.0 String, List, Tuples, set and Dictionary	12	CO-3	18	5	3	10
Unit-4.0 Python Functions, Modules and packages	7	CO-4	10	3	3	4
Unit-5.0 Object Oriented Programming (OOP)	12	CO-5	18	4	5	9
Unit-6.0 Exception and File Handling in Python	7	CO-6	7	2	2	3
Total	**48**	**-**	**70**	**20**	**18**	**32**

J) **Theory Session Outcomes (TSOs) and Units: T2400104** The details of TSOs and units for communication in English is mentioned in Part – A while communication in Hindi is mentioned in Part – B in the following table.

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
Part -A (English) TSO1.a Define communication and its different forms. TSO1.b Explain the elements of communication with Case Studies from Bhagwat Geeta's conversation between Krishna and Arjun before the war. (IKS) TSO1.c Explain the linkages between different stages of communication with the help of a diagram. TSO1.d Apply the principles of effective communication and state two examples of communication from Ramayana (IKS) TSO1.e State eight for explaining different types of barriers to communication Case Studies from Mahabharata - the conversation between Kauravas and Pandavas in the war field (IKS) TSO1.f Identify the barriers to communication. TSO1.g Suggest the ways to overcome/minimize communication barriers.	**Unit-1.0 Communication** 1.1 Communication: Role, Relevance, Elements (Context-Sender-Message-Channel-Receiver-Feedback) 1.2 Process / Stages: Ideation- Encoding, Selecting Proper Channel, Transmission, Receiving, Decoding, Giving Feedback 1.3 7 Cs / Principles of Effective Communication: Considerate, Correct, Concrete, Concise, Clear, Complete. Courteous 1.4 Barriers to Communication: Physiological, Physical, Psychological, Mechanical, Semantic/Language, Cultural. Overcome/ minimize Barriers. 1.5 Case Studies from: • Bhagwat Geeta's conversation between Krishna and Arjun before the war (IKS) • Mahabharata the conversation between Kauravas and Pandavas in the war field (IKS)	CO1 CO2
TSO 2a. Distinguish between formal and informal communication Case Studies from Bhagwat Geeta and the different conversations of Krishna and Arjun during the war (IKS). TSO 2b. Illustrate the types of Formal Communication with examples. TSO 2c. Define verbal & non-verbal communication. TSO 2d. Explain the advantages of oral and written Communication. TSO 2e. Interpret non-verbal codes from Mahabharata (IKS) TSO 2f. Explain the role of tables, charts & graphs in communication. TSO 2g. Differentiate Intrapersonal and Interpersonal Communication with Case Studies TSO 2h. List the advantages and disadvantages of Group Communication.	**Unit- 2.0 Types of Communication** **2.1** Based on organizational structure: Formal (Vertical, Horizontal, Diagonal), Informal (Grapevine) 2.2 Based on the method of expression: Verbal-Oral & Written communication. Non-verbal communication and its Codes- Kinesics, Chronemics, Proxemics, Haptics, Vocalics/Paralanguage, Artifacts, Graphic and Visual Communication 2.3 Based on the number of people involved: Interpersonal, and Group Communication. 2.4 Case Studies from Bhagwat Geeta's different conversations with Krishna and Arjun during the war (IKS).	CO3
TSO 3a. Prepare a glossary of new words from the given texts. TSO 3b. Summarize the given texts in your own words. TSO 3c. Recognize the types of sentences in the given texts.	**Unit-3.0 Reading Comprehension** Comprehension, vocabulary enhancement and grammar exercises based on the reading of the following texts: **Section-1 (Prose)**	CO4 CO5

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 3d. Find out idioms and phrases used in the given texts. TSO 3e. Write a short biography of the given writers. TSO 3f. Identify the figures of speech used in the given texts. TSO 3g. Classify the forms of poetry. TSO 3h. Elaborate the central idea / theme of the given poems in your own words.	3.1 An Astrologer's Day by R K Narayan 3.2 Indian Civilization and Culture by M K Gandhi 3.3 The Secret of Work by Swami Vivekanand 3.4 My Struggle for an Education by Brooker T Washington **Section-2 (Poetry)** 3.5 Where the Mind is without Fear by R N Tagore 3.6 Ode on Solitude by Alexander Pope 3.7 Stopping by Woods on a Snowy Evening by Robert Frost 3.8 A Psalm of Life by H W Longfellow	
TSO 4a. Form new words adding prefix and suffix to the given root words. TSO 4b. Write synonyms and antonyms of the given words. TSO 4c. Use the given idioms and phrases in your own sentences. TSO 4d. Distinguish between acronym and abbreviation. TSO 4e. Prepare a list of technical jargons of your respective branch. TSO 4f. Identify the parts of speech of the specific words in the given sentences. TSO 4g. Fill in the blanks with suitable verb forms in the given sentences. TSO 4h. Transform the given sentences as directed. TSO 4i. Punctuate the given paragraphs.	**Unit-4.0 Vocabulary and Grammar** 4.1 Word Formation: Prefix, Suffix, Acronym 4.2 Synonyms, Antonyms, Homonyms, One Word Substitution, Idioms and Phrases 4.3 Technical Jargons -Related to the respective program 4.4 Parts of speech 4.5 Time and Tense 4.6 Transformation: Voice, Narration, Removal of 'Too', Question Tag 4.7 Punctuation	CO4, CO5
TSO 5a. Write the precis of the given passage with suitable title. TSO 5b. Draft letters and applications for the given purpose. TSO 5c. Compose E-mails, Notices, Memos, and Circulars. TSO 5d. Prepare reports of the projects of your respective branch. TSO 5e. Write a report on the events organized in your institute.	**Unit-5.0 Professional Writing** 5.1 Precis Writing 5.2 Business Letters / Applications 5.3 Drafting E-mails, Notices, Memos, Circulars 5.4 Report Writing: Project and Event/ Incident Report Writing	CO5
Part -B (हिंदी) TSO 1a सम्प्रेषण कौशल का अर्थ स्पष्ट कर सकेंगे। TSO 1b भाव एवं सम्प्रेषण में अंतर बता पाएँगे। TSO 1c सम्प्रेषण की प्रक्रिया का उल्लेख कर सकेंगे। TSO 1d श्रवण अविव्यक्ति, वाचन और लेखन की अवधारणा को स्पष्ट कर सकेंगे। TSO 1e सम्प्रेषण कौशल के निर्धारक तत्वों का विवेचन कर सकेंगे। TSO 1f प्रभावशाली सम्प्रेषण के सिद्धांतों का समावेश	Units-1.0: सम्प्रेषण सिद्धान्त एवं व्यवहार 1.1 सम्प्रेषण : परिचय , अर्थ एवं परिभाषा 1.2 सम्प्रेषण की प्रक्रिया एवं तत्व 1.3 सम्प्रेषण के प्रकार : औपचारिक एवं अनौपचारिक, शाब्दिक एवं अशाब्दिक 1.4 प्रभावशाली सम्प्रेषण के सिद्धांत एवं सम्प्रेषण व्यवधान	CO1, CO2, CO3

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
अपने वार्तालाप में कर सकेंगे.	**कुरुक्षेत्र में श्रीकृष्ण- अर्जुन संवाद** महाभारत युद्ध प्रारम्भ होने से पहले कुरुक्षेत्र में श्री कृष्ण ने अर्जुन के प्रश्नों के उत्तर देते हुए जीवन के सूत्र समझाए थे।ये उपदेश श्रीमद्भागव गीता में मिलते	
TSO 2a तकनीकी कौशल एवं व्यवहार कौशल में अन्तर बता पाएँगे . TSO 2b व्यवहार कौशल का म महत्व स्पष्ट कर पाएँगे . TSO 2c आत्म जागरूकता एवं आत्म विश्लेषण का विवेचन सोदाहरण कर पाएँगे . TSO 2d भावनात्मक बुद्धिमत्ता एवं करुणा, अनुकूलनशीलता एवं लचीलापन का विकास कर पाएँगे. TSO 2e दैनिक जीवन में अनुकूलनशीलता एवं लचीलापन को आत्मसात कर पाएँगे .	**Unit-2.0: व्यावसायिक उत्कृष्टता हेतु व्यवहार कौशल** 2.1 परिचय : तकनीकी कौशल एवं व्यवहार कौशल 2.2 व्यवहार कौशल का महत्त्व 2.3 जीवन कौशल : आत्म जागरूकता एवं आत्म विश्लेषण 2.4 वनात्मक बुद्धिमत्ता एवं करुणा, अनुकूलनशीलता एवं लचीलापन, व्यवहार कौशल का उपयोग **श्रीराम केवट संवाद** श्रीराम जब लक्ष्मण और सीता के साथ वन गमन के लिए प्रस्थान करते हैं तब सरयू नदी के पार उतारने लिए केवट से अनुरोध करते हैं।	**CO1**
TSO 3a पठित गद्यांश एवं पद्यांश से प्राप्त नयी शब्दावली विकसित कर पाएँगे TSO 3b दिए गये कहानियों, कविताओं एवं निबंधों का सारांश अपने शब्दों में लिख पाएँगे. TSO 3c दिए गये कहानियों, कविताओं एवं निबंधों में प्रयुक्त मुहावरों एवं अलंकारों को बता पाएँगे . TSO 3d कविताओं का भावार्थ स्पष्ट कर पाएँगे .	**Unit-3.0: पाठ-बोध : शब्दावली परिवर्धन एवं व्याकरण अभ्यास** 3.1 नमक का दरोगा, ईदगाह – मुंशी प्रेमचंद 3.2 बात (निबंध)- प्रताप नारायण मिश्र 3.3 वह प्रदीप जो दिख रहा है झिलमिल दूर नहीं है – रामधारी सिंह दिनकर 3.4 नर हो न निराश करो मन को – मैथिलीशरण गुप्त 3.5 कबीर के दोहे -काल्ह करे सो आज कर , जाति न पूछो साधू की , ऐसी वाणी बोलिए	**CO4**
TSO 4a अपनी शाखा से सम्बन्धित तकनीकी शब्दावली का चयन कर पाएँगे . TSO 4b पर्यायवाची एवं विलोम शब्दों से सम्बंधित शब्दावली तैयार कर सकेंगे . TSO 4c दिये गये गद्यांशों में विराम चिह्नों का सही प्रयोग कर पाएँगे .	**Unit-4.0: शब्दवली एवं व्याकरण** 4.1 सामान्य शब्दावली 4.2 प्रशासनिक शब्दावली 4.3 शब्द भेद, अनेक शब्दों के लिए एक शब्द 4.4 विराम चिन्ह 4.5 मुहावरें एवं कहावतें	**CO4** **CO5**
TSO 5a दिए गये दिए गये गद्यांशों का संक्षेपण कर पाएँगे . TSO 5b विभिन्न प्रकार के पत्रों, आवेदनों ,सूचनाओं, विज्ञप्तियों को लिख पाएँगे . TSO 5c अपनी शाखा से सम्बंधित प्रतिवेदन लेखन कर पाएँगे . TSO 5d अपने संस्थान में हुए आयोजनों का प्रतिवेदन लिख पाएँगे.	**Unit-5.0: लेखन कौशल** 5.1 सार- लेखन 5.2 औपचारिक एवं व्यवसायिक पत्र लेखन 5.3 प्रारूप लेखन – सूचना, निविदा लेखन, प्रतिवेदन लेखन, बायोडाटा	**CO5**

Note: One major TSO may require more than one theory session/period.

K)   Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical:P2400104 These practical's are common for both Part – A and Part -B.

Practical/Lab Session Outcomes (LSOs)		S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO1.a	Identify the emotions of the speakers.	1	Emotions of the speakers.	CO1
LSO2.a	Interpret instructions of audio transcripts.	2	Instructions of audio transcripts.	CO1
LSO3.a	Solve the language puzzles based on the audio transcript.	3	Language puzzles.	CO1
LSO4.a	Repeat words on language lab software after listening to them.	4	Repetition of words	CO1
LSO5.a	Summarize the excerpt in their own words.	5	Summarize the excerpt.	CO1
LSO6.a	Answer the questions based on the listening excerpt	6	Listening excerpt	CO2
LSO7.a	Differentiate the sounds of minimal pairs, syllables, words, etc.	7	Sounds of minimal pairs, syllables words etc.	CO2
LSO8.a	Pronounce the words/ sentences correctly based on the phonetic transcription.	8	Phonetic transcription.	CO2
LSO9.a	Read out the words and sentences based on stress and intonation marks.	9	Stress and intonation.	CO2
LSO10.a	Apply the paralanguage codes in verbal dialogues to show different emotions.	10	Paralanguage Codes	CO2
LSO11.a	Integrate the non-verbal codes in their verbal dialogues.	11	Non-verbal Codes	CO2
LSO12.a	Correct the verbal and non-verbal presentations of their peer while giving feedback.	12	Feedback on Presentations	CO2
LSO13.a	Differentiate the sounds of minimal pairs, syllables, words, etc.	13	Syllables and Words	CO2
LSO14.a	Locate the dictated words from the excerpt.	14	Dictated words	CO3
LSO15.a	Arrange the correct and logical sequence of the jumbled sentences.	15	Jumbled Sentences.	CO3
LSO16.a	Read the given texts aloud with proper pauses and proper pronunciation.	16	Pronunciation.	CO3
LSO17.a	Compare the point of view with their peers.	17	Point of view of Self and Peers	CO4
LSO18.a	Identify the main ideas of the excerpt	18	Main ideas of the excerpt	CO4
LSO19.a	Prepare a list of technical jargon and register specific to their program /industry.	19	Technical Jargons	CO5
LSO20.a	Write the specifications of the machines/ equipment available in the workshops/labs.	20	Specifications of the machines/ equipment	CO5
LSO21.a	Write a report on the projects of their respective branches.	21	Report on the Projects	CO5

J)   Theory Session Outcomes (TSOs) and Units: T2425105

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Use Drawing Instruments to prepare 2D drawings manually. *TSO 1b.* Use different lines and annotations for the given situation. *TSO 1c.* Draw engineering scale for the given situation. *TSO 1d.* Choose appropriate scale factor for the drawing as per given situation. *TSO 1e.* Dimension the given geometric figure using IS SP-46 standard. *TSO 1f.* Draw the given regular geometric figure with tangents and normal. *TSO 1g.* Draw the given engineering curve.	**Unit-1.0 Basic Elements of Drawing** 1.1 Methods to use different Drawing Instruments and supporting materials. 1.2 Different lines and conventions in engineering drawing. 1.3 Engineering scales and applications: Reduced, enlarged & full size (Plain and Diagonal scale) 1.4 Dimensioning techniques: Types and applications of chain, parallel and coordinate dimensioning as per SP-46. 1.5 Geometric construction related with line. 1.6 Geometric construction related with angle. 1.7 Geometric construction related with circle & arc. 1.8 Construct polygons: • Hexagon: Using drawing tools. • Polygon (Triangle, square, pentagon, hexagon and heptagon) by general method. • Polygon (Pentagon, hexagon and heptagon) by special method. 1.9 Engineering Curves: Ellipse, Parabola, Cycloids, Involutes (Circle and Polygon) and Spiral (Archimedean).	CO1, CO2
TSO 2a. Explain the different types of projections & their uses. *TSO 2b.* Explain the terminology related to orthographic projection. *TSO 2c.* Explain the method of drawing different views in orthographic projection. *TSO 2d.* Draw the orthographic projections of the given point, line and regular plane with different orientations in first angle. *TSO 2e.* Find out true size and shape of the given inclined line and plane respectively.	**Unit-2.0 Elements of Orthographic Projections** 2.1 Concept and applications of Orthographic, Perspective, Isometric and Oblique Projections. 2.2 Projection Planes 2.3 Orthographic Projection: First and Third angle 2.4 Projection of point: • Lies in any one of the quadrants. • Lies any one of the planes. • Lies on XY line. 2.5 Projection of lines: • Parallel to both the planes, • Perpendicular to any one of the planes.	CO3

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	• Inclined to any one of the planes. 2.6 Projection of Planes: i.e. Triangle, Square, Rectangle, Pentagon, Hexagon, Circle. • Perpendicular to both the projection planes. • Parallel to one and perpendicular to another projection plane. • Projection of plane inclined to one and perpendicular to another projection plane.	
TSO 3a. Explain the orientation of a solid with respect to HP and VP. *TSO 3b.* Explain the difference between cutting plane and projection planes. *TSO 3c.* Draw the orthographic projections of the given sectioned and/or un-sectioned solid placed with the given orientation. *TSO 3d.* Find out true shape and size of the given sectioned surface. *TSO 3e.* Convert pictorial views into orthographic views. *TSO 3f.* Interpret the given orthographic views to imagine the shape of the component.	**Unit-3.0 Orthographic Projection of Un-Sectioned and Sectioned Solids** 3.1 Orthographic Projection of regular solids with their base resting on H.P. • Prism: Triangular, Square (Cube/Cuboid), Rectangular (Cuboid) and Pentagonal. • Pyramid: Triangular, Square, Rectangular and Pentagonal. • Cylinder, Cone, Sphere 3.2 Orthographic Projection of Cuboid, Pentagonal Prism and Cylinder with their base inclined to any one projection plane and parallel to another. 3.3 Orthographic Projection of Cube & Cone with their axis inclined to both the projection planes. 3.4 Section of Regular solids (i.e. Cube, Cuboid, Cylinder, Cone.) with their base resting on H.P. by a Section plane: • Parallel to one reference plane and Perpendicular to another. • Inclined to one reference plane and Perpendicular to other. 3.5 Conversion of simple pictorial views into orthographic views.	CO3, CO4
TSO 4a. Explain the Isometric Projection, Isometric view and Isometric Scale. *TSO 4b.* Draw isometric dimensioning on the given isometric view. *TSO 4c.* Explain the Methods of constructing isometric drawing	**Unit-4.0 Isometric Projection** 4.1 Introduction to isometric projection. 4.2 Isometric scale and Natural Scale. 4.3 Isometric view and isometric projection. 4.4 Illustrative problems limited to Isometric projection of objects	CO5

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 4d. Draw Isometric View of the given object containing elements like rectangular, circular, cylindrical shapes and slots on sloping and plane surfaces. *TSO 4e.* Convert the given orthographic views into isometric View/Projection.	containing rectangular, circular, cylindrical shapes and slots on sloping and plane surfaces. 4.5 Conversion of orthographic views into isometric View/projection.	
TSO 5a. Identify parts where the concept of development of surfaces is required. *TSO 5b.* Develop the lateral surfaces of the given Prism. *TSO 5c.* Develop the lateral surfaces of the given Pyramids. *TSO 5d.* Develop the lateral surfaces of the given Cylinder and Cone.	**Unit-5.0 Development of Surfaces** 5.1 Development of lateral surfaces of Triangular Prisms and Square Prisms (Cube and Cuboid) 5.2 Development of lateral surfaces of Triangular Pyramids (Tetrahedron) and rectangular pyramids. 5.3 Development of lateral surfaces of Cylinders and Cones.	CO6
TSO 6a. Sketch the given straight line, square, rectangle, circle and arc. *TSO 6b.* Sketch the given simple orthographic and isometric views of the given part. *TSO 6c.* Sketch the given engineering element/component.	**Unit-6.0 Free Hand Sketches of Engineering Elements** 6.1 Materials for Sketching. 6.2 General Guidelines for Freehand Sketching. 6.3 Freehand sketching of straight lines, square, rectangle, circles and arcs. 6.4 Free hand sketches of orthographic views. 6.5 Free hand sketches of isometric views. 6.6 Freehand sketching of engineering elements/components (e.g. Bolt, Nut, Washer, Stud, Screw, Simple machine parts, etc.)	CO7

Note: One major TSO may require more than one Theory session/Period.

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical:

P2425105

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Use manual drawing instruments *LSO 1.2.* Draw simple 2D entities using manual drawing instruments.	1.	Geometric Construction: • Draw set of lines with different conditions (two problems). • Draw circle and arcs with different geometric conditions and constraints (two problems). • Draw polygons by general methods (Triangle, square, pentagon, hexagon, heptagon) (Three problems). • Draw polygons by special methods (Pentagon, hexagon and heptagon) (Three problems). • Draw various problems related to tangency of circle and point (two problems). • Draw a typical Title block.	CO1, CO2
LSO 2.1. Draw conic sections using manual drawing instruments. *LSO 2.2.* Use different methods of construction of engineering curves.	2.	Conic Sections and Engineering curves: • Construct ellipse using concentric circle method, four center method, arc of circle method, rectangle method, oblong method and eccentricity method. • Construct parabola using rectangular method, parallelogram method, tangent method and eccentricity method. • Construct hyperbola using rectangular method, oblique method and eccentricity method. • Construct hypocycloid & epicycloid. • Construct involute of circle. • Construct involute of polygons. • Construct Archimedean spiral	CO2
LSO 3.1. Project the given points, lines and regular planes with different orientations on reference planes using the method of orthographic projection. *LSO 3.2.* Find out true length and shape of the given inclined line and plane respectively.	3.	Orthographic Projection of Points, Lines and Planes: • Exercise on projection of points. (Three problems) • Exercise on projection of lines. (Six problems) • Exercise on projection of planes. (Six problems)	CO3

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 4.1. Apply the concepts of orthographic projection in drawing the various views of the given simple object on drawing sheet. *LSO 4.2.* Visualize the three views related to the given object based on its shape and orientation. *LSO 4.3.* Draw the three views of an un sectioned solid using method of orthographic projection.	4.	Draw Orthographic projections of following using first angle method: • A frustum of a hexagonal is placed in first quadrant with its axis perpendicular to H.P. and parallel to V.P • A pentagonal pyramid is placed in first quadrant with its axis parallel to H.P. and V.P • Cuboid, Pentagonal Prism and Cylinder with their base inclined to any one projection plane and parallel to another. • Cube with their axis inclined to both the projection planes. • Cone with their axis inclined to both the projection planes. • Different objects having cylindrical surfaces, ribs. • Conversion of simple pictorial views into orthographic views.	CO3, CO4
LSO 5.1. Apply concepts of orthographic projection to draw different views of the given sectioned solid object on drawing sheet. *LSO 5.2.* Draw true shape and size of the given sectioned surface.	5.	Section of Regular solids (i.e. Cube, Cuboid, Cylinder, Cone.) with their base resting on H.P. by a Section plane: • Parallel to one reference plane and Perpendicular to another. • Inclined to one reference plane and Perpendicular to other.	CO4
LSO 6.1. Use concepts of Isometric projection to draw the given simple object with plain and slant surfaces.	6.	Draw Isometric view of simple objects having plain and slanting surface by using natural scale. (Three problems)	CO5
LSO 7.1. Convert the given 2D figures/views into 3D object using isometric projection. *LSO 7.2.* Visualize the 3D shape of the given object by identifying the missing elements.	7.	• Convert the orthographic views of an object to isometric view (Two problems) • Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views in sketch book.	CO4, CO5
LSO 8.1. Correlate the concept of development of surfaces with sheet metal work. *LSO 8.2.* Develop the lateral surfaces of primitive solids.	8.	Development of lateral surfaces of: • Triangular Prisms and Square Prisms (one problem each) • Triangular Pyramids (Tetrahedron) and rectangular pyramids. (one problem each) • Cylinders and Cones. (one problem each)	CO6

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
		• Funnel, chimney and pipe bend. (one problem each)	
LSO 9.1. Draw free hand sketches of the given domain specific object/component. LSO 9.2. Draw 3D free hand sketches from the given isometric shape. LSO 9.3. Draw 3D free hand sketches of the given real object/component.	9.	Draw free hand sketches/conventional representation of • Domain specific components (Three problems) • All above isometric drawings (prepared in Sr. No. 06) without using any instruments. Given the 3D model of an object, student will try to imagine the three views and draw them with free hand in the sketch book.	CO7

L) **Suggested Term Work and Self Learning S2425105:** Some sample suggested assignments, micro project and other activities are mentioned here for reference.

a. Assignments:

1. Prepare a list of industrial and household components in which conic curves are used and justify the utility of these curves.
2. Write the equations for parabola in different quadrants and observe the effect of changing eccentricity in case of parabola.
3. Exercises on drawing orthographic views of engineering domain specific simple parts.
4. Exercise on drawing isometric views of different objects.
5. Exercises on converting the orthographic views of an object to isometric view.
6. Exercise on missing views.
7. Each student should explain at least one problem for construction and method of drawing in sheet to all batch colleagues. Teacher will assign the problem of particular sheet to be explained to each student batch.
8. Each student will assess at least one sheet of other students (May be a group of 5-6 students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any.

b. Micro Projects:

1. Through experimentation, justify that the eccentricity of an ellipse is 1.
2. Cut a Cardboard/Thermocole cone with various section planes to get circle, ellipse, parabola and hyperbola.
3. Explore the applications of engineering curves in different fields of engineering and prepare a short report.
4. List the shapes and curves you are observing around you in real life with name of place and item. (For Ex. ellipse, parabola, hyperbola, cycloid, epicycloids, hypocycloid, involute, spiral helix).
5. Cut triangular, square, rectangular and circular shaped Cardboard/Thermocole pieces and observe them by placing in different positions with respect to the protection planes.
6. Take a medium sized hexagonal nut and draw its isometric projection.

I) **Course Curriculum Detailing:** This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Term Work (TW) and Self Learning (SL). Students are expected to demonstrate the attainment of Theory Session Outcomes (TSOs) and Lab Session Outcomes (LSOs) leading to attainment of Course Outcomes (COs) upon the completion of the course. While curriculum detailing, NEP 2020 related reforms like Green skills, Sustainability, Multidisciplinary aspects, Society connect, Indian Knowledge System (IKS) and others must be integrated appropriately.

J) **Theory Session Outcomes (TSOs) and Units: T2400006**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Differentiate aquatic & terrestrial ecosystem *TSO 1b.* Explain structure of ecosystem *TSO 1c.* Compare food chain & web chain *TSO 1d.* Describe carbon, nitrogen, Sulphur & phosphorus cycle *TSO 1e.* Explain causes & effect of global warming	**Unit-1.0 Ecosystem** 1.1 Aquatic & Terrestrial ecosystem 1.2 Structure of ecosystem 1.3 Food chain & Food web 1.4 Carbon, Nitrogen, Sulphur & Phosphorous Cycle 1.5 Global warming – Causes & Effects	**CO1**

TSO 2a. Explain environmental pollution & its sources.
 	
TSO 2b. Assess the causes of water & air pollution in a given area
 	
TSO 2c. Explain the effects of water & air pollution on human, plant & animal
 	
TSO 2d. Take appropriate measures to prevent the pollution problems at city /municipal areas
 	
TSO 2e. Determine the pollution level in the environment at different seasons.
	Unit-2.0 Air & Water Pollution
	
	2.1 Traditional pollution issues- Air, Water, Noise
	2.2 Water pollution
	    2.2.1 Sources of water pollution
	    2.2.2 Effects of water pollution
	    2.2.3 Control of water pollution
	    2.2.4 Physical & chemical standard of domestic water as per Indian Standard
	2.3 Air pollution
	    2.3.1 Sources of air pollution
	    2.3.2 Air pollutants
	    2.3.3 Effects of air pollution on human, plant & animal
	    2.3.4 Air monitoring system
	    2.3.5 Air pollution control
		CO2

TSO 3a. Describe various types renewable sources of energy
 	
TSO 3b. Explain solar energy & methods of harnessing
 	
TSO 3c. Explain wind energy and its impact on environment
 	
TSO 3d. Explain characteristics of biomass & its digestion process
 	
TSO 3e. Describe new energy sources & their application
	Unit-3.0 Sustainability & Renewable Sources of Energy
	
	3.1 Concept of sustainable development
	
	3.2 Renewable sources of energy for sustainable development
	
	3.3 Solar Energy
	    3.3.1 Features of solar thermal & PV system
	    3.3.2 Solar pond, Solar water heater, Solar dryer and Solar stills
	
	3.4 Wind Energy
	    3.4.1 Current status & future prospects of wind energy
		CO3

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	3.4.2 Wind energy in India- Advantages and challenges of harnessing wind energy 3.4.3 Environmental benefits & limitations 3.5 Biomass 3.5.1 Types of Biomass energy sources 3.5.2 Energy content in Biomass of different types 3.5.3 Biogas production 3.6 Concept and advantages of hydroponics or aquaponics system to demonstrate soil less cultivation and integration of fish and plant cultivation. 3.7 Water conservation and sustainable development 3.8 New Energy Sources: Hydrogen energy, Ocean energy & Tidal energy	
TSO 4a. Describe impact of climate change on human life *TSO 4b.* Identify the factors contributing to climate change *TSO 4c.* Explain sustainable development goals to transform the world *TSO 4d.* Develop implementation strategies for action plan on climate change	**Unit-4.0 Climate Change and Sustainable Development** 4.1 Impact of Climate change 4.2 Factor contributing to climate change 4.3 Sustainable development Goals (SDGs) 4.4 Action Plan on Climate Change- India	**CO4**
TSO 5a. Identify the elements of a successful management system *TSO 5b.* Explain green building concept & its benefits *TSO 5c.* Apply 5R concept in a given building construction project *TSO 5d.* Explain various environment protection laws *TSO 5e.* Explain carbon foot-print & carbon credit	**Unit-5.0 Environmental legislation and Sustainable Building Practices** 5.1 Environment management system and Planning 5.2 Green Building concept 5.3 Green and sustainable building materials -5R concept 5.4 Environment protection acts, legislation and Laws 5.5 Zero carbon foot-print building for sustainable constriction.	**CO5**

Note: One major TSO may require more than one Theory session/Period.

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2400006

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Use of Air pollutant analyzer to determine the air pollution level *LSO 1.2.* Collect air samples for pollution level detection	1.	Determination of air pollutants harming local environment	CO2
LSO 2.1 Use of Water pollutant analyzer to determine the water pollution LSO 2.2 Collect water samples for pollution level detection	2	Determine the water pollutants harming local environment	CO2
LSO 3.1 Prepare report on EIA of a given context and area. LSO 3.2 Collection of stakeholders view on effect on environment about a particular project/activity.	3.	Carry out the Environmental Impact Assessment (EIA) for a given project /activity of development	CO1 CO3
LSO 4.1 Predict of possible factors causing effects of climate change LSO 4.2 Effect of Ice melting on sea water	4.	Assessment of the impact of climate change on local environment	CO1 CO4
LSO 5.1 Elaborate the uses of sustainable building materials, the considering 3R LSO 5.2 Trace of Carbon foot print due to construction of a small building	5.	Demonstration of sustainable building materials in lab/workshop	CO2 CO5
LSO 6.1 Set up sample recycling bins in the laboratory LSO 6.2 Appreciate the importance of recycling and environmental benefits LSO 6.3 Explain the importance of 3 R	6.	Demonstration of the recycling process for the different materials such as paper, plastic etc. for waste management	CO3
LSO 7.1 Explain the process of composting LSO 7.2 disseminate the use of composting process to near and dear for soil health and fertility for generating organic food	7	Setting up composting bins in the laboratory to demonstrate the process of composting organic waste	CO3
LSO 8.1 Calculate own water footprint for daily activities LSO 8.2 Explain the importance of reducing water consumption and conserve water resources.	8	Calculation of personal water footprint for daily water usage for activities like bathing, cooking and laundry.	CO3
LSO 9.1 Explore the alternative / renewable sources of energy in day to day life	9.	Develop bio mass energy in the laboratory	CO3 CO4
LSO 10.1 Explore the alternative / renewable sources of energy in day to day life	10.	Develop solar model in the laboratory	CO3
LSO 11.1 Explore the alternative / renewable sources of energy in day to day life	11.	Develop wind turbine model in the laboratory	CO4